ONEIDA COUNTY DEPARTMENT OF PUBLIC WORKS

DIVISION OF ENGINEERING

VOLUME III

SPECIFICATION BOOK (DIVISIONS 26-41)

FOR

CONSTRUCTION

MOHAWK VALLEY COMMUNITY COLLEGE

SCIENCE AND TECHNOLOGY BUILDING

NEW CONSTRUCTION

1101 SHERMAN DRIVE, UTICA, NY

BID PACKAGES:

GENERAL CONSTRUCTION - CONTRACT NO.	H2455701
SITEWORK CONSTRUCTION - CONTRACT NO.	H2455702
ROOFING CONSTRUCTION - CONTRACT NO.	H2455703
FIRE PROTECTION CONSTRUCTION - CONTRACT NO.	H2455704
PLUMBING CONSTRUCTION - CONTRACT NO.	H2455705
MECHANICAL CONSTRUCTION - CONTRACT NO.	H2455706
ELECTRICAL CONSTRUCTION - CONTRACT NO.	H2455707

SEPTEMBER 23, 2025

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ONEIDA COUNTY EXECUTIVE

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GENERAL PROVISIONS

PART 1 – GENERAL

1.01 RELATED PORTIONS OF THE SPECIFICATION

A. Work in this division shall be subject to the applicable portions of the bidding documents.

1.02 SCOPE OF WORK

A. Furnish and install equipment and materials required to provide **a** complete electrical system.

1.03 REQUIREMENTS

A. Systems shall conform with the applicable portions of American National Standards Institute (ANSI), Institute of Electrical and Electronics Engineers (IEEE), Insulated Power Cable Engineers Association (IPCEA), National Electrical Manufacturer's Association (NEMA), International Electrical Testing Association (INETA) and the associated utility company standards.

B. Systems shall conform with the applicable portions of the requirements set forth in the National Electrical Code (NFPA-70 2020 Edition).

C. Components and/or systems tested by Underwriters Laboratories, or other suitable nationally recognized independent testing laboratories, shall bear the associated label, seal or stamp of conformance.

1.04 MANUFACTURER'S SAFETY DATA SHEETS (MSDS)

A. Provide a bound, indexed assembly of pertinent equipment and materials (including applicable subcontractor items).

1.05 CONNECTIONS TO UTILITIES

A. Furnish and install feeders interfacing with public and/or site utilities in accordance with the sizes and locations shown on the drawings IN STRICT COMPLIANCE WITH THE RULES AND REGULATIONS SET FORTH BY THE AUTHORITY HAVING JURISDICTION, complete with tests, final connections and appurtenances as required.

1.06 CONNECTIONS TO EQUIPMENT THAT IS EXISTING AND/OR FURNISHED BY OTHERS

A. Furnish and install branch circuits serving equipment that is existing and/or furnished by others in accordance with the sizes and locations shown on the drawings, complete with final connections, including provisions for disconnects and receptacles as required.

1.07 FABRICATION DRAWINGS, MATERIAL LISTS AND EQUIPMENT SUBMITTALS

A. Prior to installation, submit fabrication drawings, material lists and equipment submittals (shop drawings) and short circuit/coordination summary for approval in accordance with the following:

1. It is the intent of these specifications to define the requirements for fabrication drawings, material lists and equipment submittals. Questions regarding these requirements shall be directed to the Engineer prior to submission.

2. Fabrication drawings and material lists shall conform with the requirements herein specified.

3. Equipment submittals, unless otherwise specified, shall conform to the following:

   a. Submittals shall be complete with the manufacturer's product description literature. SUBMITTALS WITH INSUFFICIENT LITERATURE WILL BE DISAPPROVED.

   b. Submittals shall include a complete listing associated parameters contained in the bidding documents (materials, finishes, capacities, electrical characteristics, etc.). THE ENGINEER WILL NOT TRANSFER INFORMATION FROM THE BIDDING DOCUMENTS TO THE SUBMITTALS. INCOMPLETE SUBMITTALS WILL BE DISAPPROVED.

   c. Submittals shall be clearly marked to differentiate between the applicable and extraneous portions. THE ENGINEER WILL NOT MARK THE SUBMITTALS. UNMARKED SUBMITTALS WILL BE DISAPPROVED.

   d. The attached Submittal Cover Sheet will be copied, filled out and attached to each item submitted.

4. SUBMITTALS (INCLUDING RE-SUBMISSIONS), PREPARED AND TRANSMITTED IN ELECTRONIC FORMAT, SHALL BE ACCOMPANIED WITH A HARD COPY COMPRISED OF ORIGINAL, PRINTED PRODUCT LITERATURE (PHOTOCOPIES ARE NOT ACCEPTABLE).

5. ADDITIONALLY, ELECTRONIC SUBMITTALS WHICH DO NOT CONFORM WITH THE ABOVE REQUIREMENTS WILL NOT BE REVIEWED, BUT RATHER DELETED WITH A CORRESPONDING TRANSMISSION: "REJECTED, NON-COMPLIANT SUBMISSION!"

6. Unless otherwise noted or herein specified, the following is required:

   a. Material lists:

      1) Wire and conduit.

      2) Supporting systems.

      3) Overcurrent protection devices.

      4) Fuses.

      5) Surface raceway systems.

6) Grounding systems components.

7) Identification.

b. Equipment submittals:

1) Receptacles and switches.

2) Occupancy sensors.

3) Luminaires.

4) Wireless lighting systems controls.

5) Switchboards/panelboards.

6) Disconnects/safety switches.

7) Combination mass notification/emergency communication and Addressable fire alarm and detection systems.

8) Emergency lighting systems.

9) Exit lights.

10) Motor control centers/starters/contactors.

11) Uninterruptible power systems.

12) Engine/alternators and automatic transfer switches.

13) 3 way manual transfer switch.

14) Transformers.

15) Security systems.

16) Access control systems.

17) Electric cord reels.

18) Lighting control systems.

19) Emergency phone system.

20) Communications cabinets, racks, frames and enclosures.

21) Communications terminal blocks, patch panels and patch cords/jumpers.

22) Communications cable management.

28) Grounding and bonding for communications systems.

29) Communications cable-copper.

30) Communications cable-fiber optic.

31) Strut mount continuous cable support system.

32)

c. SIGNED AFFIDAVIT (attached) attesting to strict compliance with the manufacturing/source requirements hereinafter described for each material list or equipment submittal.

d. Short circuit and coordination summary:

1) Tabulate distribution interrupting rating/overcurrent protection relationships.

2) Record appropriate adjustable trip settings.

PART 2 – PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Materials and equipment shall be in strict accordance with the parameters herein specified.

B. Material and/or equipment of the same category (e.g.: service entrance equipment, panelboards, load centers, circuit breakers, receptacles, switches, etc.) shall be of the same manufacturer; special systems which are a composite of several manufacturer's components (e.g., fire alarm, security alarm, communication) shall be supplied and serviced by a single source of responsibility.

2.02 ACCESSORIES AND COMPONENTS

A. It is the intent of this specification that systems and equipment shall be complete with the necessary quantity of accessories and components required to insure a properly functioning installation.

2.03 UNDERWRITERS LABORATORIES **(SED ONLY)**

A. Packaged (multiple component) equipment shall have a composite Underwriters Laboratory listing.

B. Individual equipment shall have an Underwriters Laboratory listing.

PART 3 – EXECUTION

3.01 INSTALLATION

A. Work shall be expeditiously executed in a well-planned, organized, neat, workmanship like manner.

B. Unless otherwise noted or herein specified, materials and equipment shall be installed in strict accordance with the manufacturer's recommendations.

C. Electrical work herein specified and/or noted shall be executed in strict conformance with the National Electrical Code.

D. Work shall be executed by tradesmen licensed as requires by the authority having jurisdiction.

3.02 REMOVALS

A. Unless otherwise noted or herein specified, equipment and materials shown and/or specified to be removed (including related accessories and appurtenances) shall become the Contractor's property and shall not be permitted to accumulate but shall be promptly removed from the job site.

B. The disposal of components containing asbestos and/or polychlorinate biphenyls (PCB's) shall be in strict conformance with governing federal, state and local regulations.

C. Work shall be carefully executed to prevent the disruption of, or damage to, new work or existing work which is to remain.

3.03 CEILING PLENUM SPACE COORDINATION

A. Unless otherwise shown and/or noted, mechanical/electrical distribution systems shall generally be arranged in the following descending order:

1. Branch sprinkler piping and feeder conduits (highest).

2. Ductwork.

3. HVAC hydronic piping and plumbing piping (lowest).

B. Branch circuit conduits shall be accommodating as required.

3.04 PROTECTION

A. Materials, equipment and accessories shall be suitably covered and protected during construction.

B. Materials, equipment and accessories damaged during construction shall be replaced at no cost to the Owner.

3.05 SUPPORTS

A. Provide auxiliary steel (beams, channels, angles, formed shapes, etc.) required to properly support equipment and distribution systems.

B. Utilize galvanized components (wherever practical) or field apply 2 coats of corrosion resistant primer.

C. Seismic anchorages, restraints and equipment supports shall comply with National Uniform Seismic Installation Guidelines.

3.06 FINAL CLEANING, ELECTRICAL ROOMS

A. Remove trash and debris.

B. Thoroughly sweep (using sweeping compound) and subsequently vacuum floors.

C. Hand wash wall surfaces and equipment and remove any foreign substance (adhesive, extraneous paint, droppings, etc.).

D. Damp-mop floors.

3.07 RECORD DRAWINGS

A. Promptly record (in a neat, legible and red-color-only accentuated fashion, on a complete, designated set of bidding documents containing no other markings) significant differences reflected by the actual installation (sizes, capacities, locations and features of distribution systems and equipment).

B. Additionally, prepare appropriately scaled drawings showing conduit locations below grade and within concrete slabs.

3.08 OPERATION AND MAINTENANCE MANUAL

A. Near the completion of work, submit three bound, neatly arranged, indexed Operation and Maintenance Manuals for approval.

B. Manuals shall be contained in heavy duty, 3-ring vinyl covered loose-leaf binders (suitable sets of MANAGEABLE SIZE, like equipment and systems grouped) complete with:

1. Typewritten description of contents within a clear plastic sleeve on the spine.

2. Dividers with labeled, celluloid covered tabs.

3. Protective plastic jacket enclosures for diagnostic software.

C. Manuals shall contain:

1. Title page delineating:

a. Name of project.

b. General nature of contents.

c. Name and address of Contractor and Engineer.

d. Applicable cross-references to related volumes.

2. Table of contents listing equipment (including the associated alphanumerical designation) and the corresponding section (tab).

3. Pertinent equipment information, including:

a. Manufacturer and serial number.

b. Approved submittal.

c. Operating and maintenance instructions.

d. Names, addresses and telephone numbers relative to parts and service.

4. Distribution summaries for switchgear, switchboards, motor control centers and panelboards.

5. Closeout documentation:

a. Waiver of liens.

b. Electrical inspection certificate.

c. Pertinent equipment warranties.

e. Fire alarm system test report and device addresses.

f. Record drawings.

3.09 INSPECTION

A. Obtain New York Board of Fire Underwriters (NYBFU) or Independent Electrical Inspection Agency (IEIA) inspection certificate and deliver to the Engineer.

3.10 PERFORMANCE

A. Disconnect switches:

1. Furnish and install disconnect switches in strict accordance with National Electrical Code.

B. Circuit Numbers:

1. Circuit numbers shown on the drawings are for reference only and may not be the same as the final connections.

2. Rearrangement of connections may be made to suit the convenience of the Owner, Contractor or Material Supplier.

3. Fixtures, devices or equipment shown to be on a common circuit may not be rearranged to other circuits without permission from the Engineer.

4. Circuit numbers or connections changed from those shown on the drawings shall be so noted on the "Project Record Documents" (as-built drawings).

5. Circuits and numbers actually used shall be entered in the directory of the associated panelboard.

3.11 POWER DISTRIBUTION SYSTEM CHECK OUT

A. Subsequent to testing, concurrently energize related branch circuit loads on a feeder-by-feeder basis and correct associated phase imbalance.

3.12 PUNCH LIST

A. When the Engineer is directed or requested to prepare a summary of incomplete work, the Contractor's Project Manager and Foreman shall visit the job site with the Engineer's Representative(s).

B. Thereafter, the Contractor's Project Manager shall direct his Foreman and subcontractors to complete observed incomplete work.

C. Finally, the Contractor's Project Manager and Forman shall visit the job site with engineer's representative(s) to determine any remaining incomplete work.

D. As required, items B. and C. shall be repeated until work is properly completed.

3.13 SYSTEMS DEMONSTRATION

A. Subsequent to completing the electrical systems, the Electrical Contractor in conjunction with the Engineer shall orchestrate a demonstration of the applicable systems (commercial power, standby power, uninterruptible power, lighting, fire alarm, security, communication, etc.) in accordance with the parameters herein specified.

B. In addition to the Engineer's representative(s), the following parties shall participate:

1. The Electrical Contractor's project manager and job site foreman.

2. The electrical equipment and/or principal subsystem supplier's service technicians, as requested by the Engineer.

3.14 INSTRUCTION

A. Provide thorough, organized instruction regarding equipment and systems operation to the Owner's authorized representatives secure written acknowledgement and forward to the Engineer.

END OF SECTION

ATTACHMENT: Submittal Cover Sheet
Equipment and Materials Manufacturing/Source

SUBMITTAL COVER SHEET

CONTRACTOR: _____

ADDRESS: _____

_____

TELEPHONE: _____

DATE: _____

NOTE: ATTACH A COMPLETED COVER SHEET TO EACH COPY

PROJECT: MVCC Science & Technology Building Renovation
PROJECT # 23000

TYPE OF SUBMITTAL (CHECK):

[ ] FABRICATION DRAWING
[ ] MATERIAL LIST
[ ] EQUIPMENT
[ ] SAMPLE
[ ] COLOR SAMPLE
[ ] _____

DESCRIPTION:

PRODUCT NAME: _____

MANUFACTURER: _____

SUBCONTRACTOR/SUPPLIER: _____

ENGINEER REVIEW STAMP

[ ] NO EXCEPTION TAKEN [ ] REVISE AND RESUBMIT
[ ] FURNISH AS CORRECTED [ ] REJECTED

Checking is only for conformance with the design concept of the project and compliance with the information given in the Contract Documents. Contractor is responsible for dimensions to be confirmed and correlated at the job site, for information that pertains solely to the fabrication process or to techniques of construction, and for coordination of the work of all trades.

TOWNE ENGINEERING
Consulting Engineers

Date _____ By _____

CONTRACTOR REVIEW STAMP

REMARKS:

SECTION 26 60 30

TESTS

PART 1 – GENERAL

1.01 REQUIREMENTS

A. Test each completed portion of the wiring system before it is energized. (Do not test outdoor grounding systems within 48 hours of rainfall).

B. Provide all required test equipment and energy.

1.02 REPORTS

A. Complete reports of all high voltage and grounding tests shall be submitted in duplicate by the Contractor to the Engineer, indicating the date, weather conditions, persons present, instruments used, hook-up and location diagrams as necessary, test results, corrective actions taken if applicable, and results of retesting if applicable.

PART 2 – PRODUCTS

Not Used

PART 3 – EXECUTION

3.01 WIRING SYSTEMS – 600 VOLTS OR LESS

A. Test all conductors for opens, shorts and grounds.

3.02 GROUNDING SYSTEMS

A. Check conduit systems for "grounds" at convenient points such as outlets located near plumbing systems or building structural steel.

B. Test all ground rods for grounding resistance before grounding conductors are connected.

C. Buried grounding conductors or loops shall be connected to the ground rods and tested as a system.

D. Test the "service ground" point for ground resistance.

E. Demonstrate that derived grounds at transformer secondaries are "grounded".

F. Check system neutrals and equipment grounding conductors separately for opens, shorts and unintentional grounds before interconnection to the grounding system.

END OF SECTION

SECTION 26 60 40

OVERCURRENT PROTECTIVE DEVICE AND COORDINATION STUDY

PART 1 – GENERAL

1.01 REQUIREMENTS

A. Provide an engineering analysis and coordination study for the entire electrical distribution system. The analysis shall include a short-circuit with protective device evaluation, a protective device coordination study and arc flash calculations.

B. The study shall begin at the point of utility service for the facility and continue down thru the electrical distribution system to all downstream distribution and branch circuit panelboards, motor control centers and significant motor loads.

C. The analysis shall include any generators and any associated emergency power distribution equipment, including automatic transfer switches and generator ground fault protection.

D. Shop drawings for equipment effected by the coordination study will not be reviewed until the coordination study has been submitted and approved.

1.02 RELATED DOCUMENTS

A. One line power diagrams.

B. Specifications.

1.03 STUDY REQUIRMENTS

A. The study shall be in accordance with IEEE and NFPA standards.

B. The study shall include one line power diagram, short-circuit and ground fault analysis, protective coordination plots for all overcurrent protective devices, and arc flash calculations and analysis.

1.04 QUALITY ASSURANCE

A. The firm executing the study shall have at a minimum a four-year record of successful in-service performance for systems similar to this project.

B. Short-circuit analysis and coordination study shall be performed by a registered Professional Engineer in the state that the project is located in.

PART 2 – PRODUCTS

2.01 SHORT-CIRCUIT ANALYSIS WITH PROTECTIVE DEVICE COORDINATION

A. Systematically calculate fault currents based upon the available fault current at the facility service entrance, obtain available fault current from the local utility.

B. The study shall be prepared using computer software utilizing a commercially available software package. Results of short-circuit calculations shall be presented in tabular form and shall include momentary and interrupting fault values for three-phase and phase-to-ground faults.

C. Calculate the fault impedance to determine the available short-circuit and ground fault currents at each bus. Incorporate applicable motor and/or generator contribution in determining the momentary and interrupting ratings of the overcurrent protective devices.

D. Analyze the short-circuit currents by preparing a tabulation comparing the fault levels to the device interrupting ratings. The following information shall be included:

   a. Bus identification number.

   b. Location identification.

   c. Voltage.

   d. Manufacture and type of equipment.

   e. Device rating.

   f. Calculated short-circuit current.

2.02 PROTECTIVE DEVICE COORDINATYION STUDY

A. Prepare coordination time-current characteristic curves to determine the required settings/sizes of the protective devices to maximize selectivity. The utility upstream protective device feeding the facility shall be maintained as the upper limit for coordination. These settings shall be obtained by the preparer, along with any other protective device setting requirements. The coordination curves shall be prepared on log-log paper and illustrate adequate clearing times between series devices. The curves shall be created thru the use of the study software but must reflect actual protective devices to be installed. Adequate time-current curves shall be generated to depict coordination. In addition, protective device characteristics shall be suitably determined to reflect calculated short-circuit levels at the location.

B. A narrative analysis shall accompany each coordination curve sheet and describe the coordination and protection in explicit detail. All curve sheets shall be multi-color for improved clarity. Areas lacking complete coordination shall be highlighted and reasons provided for the coordination issues. System coordination, recommended ratings, and settings of protective devices shall be accomplished by a registered professional electrical engineer.

C. The following information shall be provided on all curve sheets:

   a. Device identification and associated settings/size.

   b. Voltage at which curves are plotted.

c. Current multiplier.

d. ANSI frequent fault damage curve.

e. Cable insulation damage curves.

f. Transformer inrush point.

g. One line power diagram for the system.

h. Motor starting profiles.

2.03 ARC FLASH CALCULATIONS AND ANALYSIS

A. An arc flash analysis shall be performed in conjunction with a short circuit study. Calculations shall be based upon actual over-current protective device clearing time. Maximum clearing time shall be in accordance with IEEE 1584. Analysis shall be based upon the lowest clearing time setting of the overcurrent protective device to minimize the incident energy level without compromising selective coordination.

B. The results from the short circuit study shall be used to determine arc energy levels at each defined location in the facility for a specified working distance. Based on the arc energy at each defined point, the proper PPE level will be determined.

C. Labels shall be provided for each evaluated location that lists the hazard levels along with the required PPE level while working in that area.

D. Analysis shall be provided to determine if any changes can be made in protection system to reduce arc energy levels.

2.04 ONE LINE POWER DIAGRAM

A. Show all electrical equipment and wiring to be protected by the overcurrent devices.

B. Show the following specific information:

a. Calculated fault impedance, X/R ratios, and short-circuit values at each feeder and branch circuit bus.

b. Switchgear, switchboards, panelboards, motor control centers, relay, circuit breaker, fuses automatic transfer switches and switches continuous current ratings.

c. Generator kw/kVA and transformer kVA and voltage ratings, percent impedance, X/R ratios, and wiring connections.

d. Voltage at each bus.

e. Identification of each bus, matching the identification on the drawings.

f. Conduit, conductor, and busway material, size, length, and X/R ratios.

PART 3 – EXECUTION

3.01 SUMMARY

A. The results of the system studies shall be summarized in a final report and submitted to the design engineer.

3.02 FIELD SETTINGS

A. Provide field adjustments of all protective devices in accordance with the approved short circuit study and protective device evaluation/coordination study.

END OF SECTION

SECTION 26 61 11

CONDUIT SYSTEMS

PART 1 – GENERAL

1.01 REQUIREMENTS

A. Furnish and install conduit systems in accordance with the parameters shown on the drawings and herein specified.

B. Systems components shall be Underwriters Laboratories listed.

1.02 MATERIAL LISTS

A. Prior to installation, submit a list of materials to the Engineer for approval which shall conform with the following:

1. Each conduit system (including conduit material, fittings, connectors, bushings, etc.) shall be listed separately.

2. Listings of conduit material and fittings shall be complete with a description of parameters contained in the Contract Documents (schedule number, material, standards, etc.). THE ENGINEER WILL NOT TRANSFER INFORMATION FROM THE CONTRACT DOCUMENTS TO THE LISTINGS. INCOMPLETE LISTINGS WILL BE DISAPPROVED.

PART 2 – PRODUCTS

2.01 DESCRIPTION

A. Rigid metal conduit (RSC):

1. Steel:

a. Conduit material:

1) Galvanized (after threading), chromated (subsequent to galvanizing), high strength steel conforming to ANSI Standard C80.1.

2) Corrosion resistant lubricating interior finish, color-coded end-cap thread protectors.

b. Fittings:

1) Couplings:

a) Threaded (where practical).

b) Threadless, malleable iron or steel, compression type (as required).

2) Connectors:

a) Insulated, threadless, malleable iron or steel, compression type (as required).

c. Bushings:

1) Insulated, malleable iron, grounding type.

d. Acceptable manufacturers:

1) Wheatland, Triangle, LTV Copperweld, Allied Tube.

B. Electrical metallic tubing (EMT):

1. Steel:

a. Conduit material:

1) Galvanized, chromated and lacquered (subsequent to galvanizing), high grade mild steel conforming to ANSI Standard C80.3.

2) Corrosion resistant lubricated interior finish.

b. Fittings:

1) Couplings:

a) Steel, as noted, compression type (exterior or damp interior application).

b) Steel, as noted, set screw type (dry interior application).

2) Connectors:

a) Insulated, steel, as noted, compression type (exterior or damp interior location).

b) Insulated, steel, as noted, set screw type (dry interior application).

c. Acceptable manufacturers:

1) LTV Copperweld, Triangle, Wheatland or approved equal.

C. Liquidtight flexible metal conduit (LTFMC):

1. Conduit material:

a. Galvanized, heavy gauge strip steel, integral continuous copper ground, extruded polyvinyl jacket conforming with the National Electrical Code, Article 351.

2. Fittings:

a. Insulated, malleable iron or steel, liquidtight type.

3. Acceptable manufacturers:

    a. Oz/Gedney, Anaconda or approved equal.

D. Rigid non-metallic conduit (RNMC):

1. Conduit material:

    a. Schedule 40 (unless otherwise noted), polyvinyl chloride (PVC).

2. Fittings:

    a. Molded polyvinyl chloride (PVC).

3. Acceptable manufacturers:

    a. Carlon, Cantex, National Pipe and Plastics or approved equal.

E. Metal-Clad cable (MC):

1. Conduit material:

    a. Galvanized, steel armor, integral continuous copper ground, conforming with the National Electrical Code, Article 330.

2. Fittings:

    a. Insulated, steel, speed-lock type.

PART 3 – EXECUTION

3.01 INSTALLATION

A. General:

1. Refer to Conduit Systems Application note under general notes on contract drawings for conduit installation requirements.

2. Metal conduit systems shall assure electrical continuity (low impedance pathway to ground).

3. Provide suitable fittings to properly compensate for expansion and deflection at building control and expansion joints.

4. Conduit shall be 1/2 inch (minimum, unless otherwise noted), except those below grade or within concrete slabs which shall be 3/4 inch (minimum); additionally, conduits for multiple branch circuits shall be 3/4 inch (maximum).

5. Plug or cap open ends and provide polypropelene pull cord in empty (spare) conduits.

6. Conduit systems shall not be permitted in concrete slabs unless specifically noted on the drawings; whereupon, it shall be installed as detailed.

B. Above grade:

1. Furnish and install conduit systems above grade (which are not in concrete slabs) substantially as shown on the drawings, as high as possible, parallel to building walls, clear of structural members (except when penetrations are shown or approved), positioned 12 inches (minimum) from hot surfaces (hot water and steam distribution systems, radiant heat transfer surfaces, convective heat transfer surface enclosures, etc.) and clear of equipment removal and service areas.

2. Unless otherwise noted, conduit systems shall be concealed in finished areas and exposed in unfinished areas.

3. Flexible metal conduit and liquidtight flexible metal conduit systems shall be bonded (at each end) to their associated equipment grounding conductors.

4. Units penetrating walls or partitions above grade (not constructed of masonry nor fire or smoke rated) shall be neatly patched with the appropriate (related) wall or partition material to insure the absence of an annular space.

5. Metal-clad cable (type MC) shall only be used for luminaire whips.

C. Below grade:

1. Furnish and install conduit systems below grade substantially as shown on the drawings, parallel to building walls (except where shown otherwise), pitched and arranged to permit effective drainage and in strict accordance with designated burial depths.

2. Provide trenching, backfilling and compacting in accordance with the requirements set forth in Division 2 and/or as shown on the drawings.

D. Sleeves:

1. Furnish and install sleeves where conduit systems pass through building walls and floors in accordance with the following:

   a. Units penetrating walls and floors below grade shall be as detailed ("Sleeves Below Grade , Floors and Walls").

   b. Units penetrating floors shall be Schedule 40, black steel (ASTM A-53) arranged to provide a waterproofing flange by projecting 1/2 inch above finished floor (except in Mechanical/Electrical Equipment Rooms where the projection shall be 2 inches above finished floor).

   c. Openings through existing walls or partitions constructed of solid masonry shall be core drilled and shall not require sleeves.

2. Seal annular spaces with intumescent, synthetic elastomer (3M brand Fire Barrier; Caulk CP 25, Putty 303).

END OF SECTION

SECTION 26 61 12

BUSWAY – LOW VOLTAGE

PART 1 – GENERAL

1.01 REQUIREMENTS

A. Furnish and install busway system in accordance with the parameters shown on the drawings and herein specified.

B. Systems shall be totally enclosed, low-impedance busway system, Underwriters Laboratories listed, complete with horizontal runs, vertical risers, fittings, power takeoffs, hanging devices and accessories.

C. Systems shall be designed, manufactured and tested in accordance with the latest standards of Underwriter's Laboratories, ANSI, NEMA and CSA.

PART 2 – PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. General Electric, I.T.E., Square D., Eaton or approved equal.

2.02 DESCRIPTION

A. Ratings:

1. The busway shall have voltage and current ratings as indicated on the contract drawings in accordance with the following:

    a. 3-phase, 3-wire.

    b. 3-phase, 3-wire with 50% housing ground and/or 50% internal ground

    c. 3-phase, 3-wire with 50% housing ground and/or 50% isolated ground.

    d. 3-phase, 4-wire with 100% neutral.

    e. 3-phase, 4 wire with 100% neutral, 50% housing and/or 50% internal ground.

    f. 3-phase, 4-wire with 100% neutral, 50% housing and/or 50% isolated ground.

    g. 3-phase, 4-wire with 200% neutral.

    h. 3-phase, 4 wire with 200% neutral, 50% housing ground and/or 50% internal ground.

i. 3-phase, 4-wire with 200% neutral, 50% housing ground and/or 50% isolated ground.

2. The busway shall have a minimum of 6-cycle short-circuit rating of 85 kA RMS symmetrical for ratings through 800 Amp, 100 kA RMS symmetrical for ratings through 1350 Amp, 125 kA RMS symmetrical for ratings through 1600 Amp, 150 kA RMS symmetrical ratings through 2500 Amp, and 200 kA RMS symmetrical for ratings through 5000 Amp.

B. Construction:

1. The busway and associated fittings shall consist of **[aluminum] [copper]** conductors totally enclosed in a 2-piece extruded aluminum housing. Outdoor feeder, indoor feeder and indoor plug-in busway shall be interchangeable at the same rating without the use of adapters or special splice plates. Where indicated on the drawings provide indoor, sprinkler-proof plug-in busway. Fittings –(elbows, tees, flanges, etc.) shall be identical for use with both the plug-in and feeder types of busway. The busway shall be capable of being mounted flat-wise, edgewise, or vertically without derating. The busway shall consist of standard 10-foot sections with special sections and fittings provided to suit the installation. Horizontal runs shall be suitable for hanging on 10-foot maximum centers. Vertical runs shall be suitable for mounting on 16-foot maximum centers. Provide one hanger for every ten feet of horizontally mounted duct. On vertical runs provide one adjustable hanger per floor.

C. Bus:

1. Bus bars shall be fabricated from high strength, [55% conductivity aluminum] [98% conductivity copper] and suitable plated at all electrical contact surfaces.

2. Bus bars shall be insulated over their entire length, except at joints and contact surfaces, with a UL listed insulating material consisting of a thermo set epoxy applied by fluidized bed process. Tape or heat-shrink sleeve insulation, or any method of insulation, which can allow air-gaps or insulation breakdown, shall not be acceptable.

3. Busway shall be capable of carrying rated current continuously without exceeding a temperature rise of 55 degrees C based on a 40 degrees C ambient.

D. Bus Joints:

1. Each busway section shall be furnished complete with joint hardware and covers. The busway joints shall be a single-bolt, non-rotating, removable bridge design. All bridge joints shall be furnished with torque-indicating double head joint bolts and Belleville washers and shall utilize a captive nut retainer on the opposite side of the torque-indicating bolt. The bridge joint design shall ensure proper installation without the use of a torque wrench, and provide visual indication that the joint has been tightened to the proper torque value. Each busway joint shall allow for a minimum length adjustment of +/- 0.5 inches. De-energization of busway shall not be required for safe testing of joint tightness.

E. Housing:

1. The busway housing shall be a 2-piece design fabricated from extruded aluminum and shall be bolted together, along the bottom flange, using grade 5, 1/4x20 zinc-plated fasteners on 3-inch centers for maximum mechanical strength. The busway enclosure finish shall be ANSI 61 gray baked epoxy powder paint applied by an electrostatic process.

2. Outdoor feeder busway housing shall be identical to indoor feeder buway housings, and shall be UL listed for outdoor use. Busway shall be completely weatherized at the factory, and designed such that only caulking of protective joint covers are required for outdoor application.

F. Plug-in Busway:

1. Busway shall be of the plug-in type, available in standard 2-, 4-, 6-, 8- and 10-foot lengths, with plug-in openings provided on both sides of the busway sections on 24-inch centers. Plug-in covers shall prohibit dirt and debris from entering contact plug-in openings in the busway. The design shall allow for ten hinged cover outlets per ten feet of plug-in length, and covers shall be field-convertible to hinge on either side. Covers for plug-in openings shall have a positive screw close feature and provisions for installation of power company seals. The contact surfaces for bus plug stabs shall be silver-plated and of the same material, thickness, and rating as the phase bars. The tabs shall be welded to the bus bars. A standard housing ground connection shall be supplied in each plug-in opening. Positive mechanical guides for plug-in units shall be provided at each plug-in opening to facilitate unit alignment and prevent improper installation.

2. Provide plug-in units of the types and ratings indicated on the plans and in the specifications. Plug-in units shall be mechanically interlocked with the busway housing to prevent their installation or removal while the switch is in the "ON" position. The enclosure of any plug-in unit shall make positive ground connection to the duct housing before the stabs make contact with the bus bars. All plug-in units shall be equipped with an interlock that can be defeated to prevent the cover from being opened while the switch is in the "ON" position and to prevent accidental closing of the switch while the cover is open. The plugs shall be provided with a means of padlocking the cover closed and padlocking the disconnect device int the "OFF" position. The operating handle and mechanism shall remain in control of the disconnect device at all times, permitting its easy operation from the floor by means of a hook stick or chain. All plug-in units shall be interchangeable without alteration or modification of plug-in duct.

3. Fusible-type plugs shall have a quick-make/quick-break disconnect switch and positive pressure fuse clips.

PART 3 – EXECUTION

3.01 FACTORY TESTING

A. Standard factory tests shall be performed on the equipment provided under this section. All tests shall be in accordance with the lates version of ANSI and NEMA

standards.

B. The manufacturer shall provide three (3) certified copies of factory test reports.

3.02 INSTALLATION

A. Exact routing shall be field determined and measured with units manufactured from dimensioned drawings.

B. Install units level and plumb and check tightness of all accessible connections with calibrated torque wrench per manufacturer's published valves.

C. The Contractors shall install all equipment per the manufacturer's recommendations and the contract drawings.

END OF SECTION

SECTION 26 61 14

CABLE TRAY (BASKET)

PART 1 – GENERAL

1.01 REQUIREMENTS

A. Furnish and install structural wire mesh (basket) cable tray system in accordance with the parameters shown on the drawings and herein specified.

B. Units shall be installed in accordance with the National Electrical Code (Article 318 and 392), National Electrical Manufacturers' Association (NEMA VE 1-1998 and VE 2-2000), National Fire Protection Association (NFPA 70B), Underwriters Laboratories listed, complete with fittings (splices, ties, elbows, bends, intersections, transitions, etc.) and all accessories (rung caps, bolts, nuts, washers, etc.) necessary for a complete system.

PART 2 – PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Cooper B-Line (Flextray), Versatray or approved equal.

2.02 DESCRIPTION

A. Material:

1. 0.196 inch diameter (minimum) high strength steel wires, 2 inch x 4 inch wire mesh pattern, intersecting wires welded, rounded edges, continuous top wire safety edge kinked and t-welded, 6 inch usable loading depth, 118 inches long, width as noted.

B. Finish:

1. Electroplated zinc galvanizing (0.7 to 0.8 mills thick) per ASTM B633, epoxy powder coat paint (color selected by Engineer).

C. Fittings:

1. Field-fabricated per manufacturer's published installation guide, adjoining sections bolted together with tee bolts.

D. Accessories:

1. Connector assemblies, splice plates, splice bars, grounding clamps, trapeze/center hangers, solid bottom inserts, covers.

PART 3 – EXECUTION

3.01 INSTALLATION

A. Furnish and install cable tray system substantially as shown on drawings, parallel to building walls, clear of structural members and clear of equipment removal and service areas.

B. Provide sufficient space encompassing wire basket to permit access for installing and maintaining cable.

C. Cable tray shall be securely mounted to the building structure with either trapeze/center rod hangers with 1/2 inch threaded rod at 10'-0" O.C. (maximum).

D. Cable tray shall be positioned level and plumb and properly aligned relative to the associated room finishes.

E. Actual locations shall be coordinated with other elements contributing to the aesthetics of the overall installation of the building systems.

F. Cable tray shall be grounded/bonded per manufacturer's directions and NFPA 70.

3.02 ON-SITE TESTING

A. With the system installation complete, test wire basket support system to ensure electrical continuity of bonding and grounding connections and demonstrate compliance with specified maximum grounding resistance in accordance with the National Electrical Code.

END OF SECTION

SECTION 26 61 20

600 VOLT WIRE AND CABLE

PART 1 – GENERAL

1.01 REQUIREMENTS

A. Furnish and install wire and cable in accordance with parameters shown on the drawings and herein specified.

B. Units shall be Underwriters Laboratories listed; complete with conductors, insulation, identification, color coding and connectors.

PART 2 – PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Cerro Wire, Encore Wire, Southwire Company, General Cable or approved equal.

2.02 DESCRIPTION

A. Conductors:

1. Material:

    a. Copper.

2. Construction:

    a. No. 10 AWG and smaller:

        1) Solid.

    b. No. 8 AWG and larger:

        1) Stranded.

B. Insulation (600 volts or less):

1. No. 10 AWG and smaller:

    a. THHN/THWN-2.

2. No. 8 AWG and larger:

    a. THHN/THWN-2.

C. Identification:

1. Clearly marked (at regular intervals) size, type, voltage, Underwriters Laboratories listing.

D. Color coding:

1. 120/240 volt, single-phase:
    a. Phase:
        1) Black, red.
    b. Neutral:
        1) White.
    c. Ground:
        1) Green.
2. 120/208 volt, 3-phase:
    a. Phase:
        1) Black, red, blue.
    b. Neutral:
        1) White.
    c. Ground:
        1) Green.
3. 120/240 volt, 3-phase:
    a. Phase:
        1) Black, orange, blue.
    b. Neutral:
        1) White.
    c. Ground:
        1) Green.
4. 277/480 volt, 3-phase:
    a. Phase:
        1) Brown, orange, yellow.
    b. Neutral:
        1) Gray.
    c. Ground:
        1) Green with yellow stripe.

E. Connectors:

1. General:

a. Factory fabricated.

b. Appropriate class, type, material, size, ampacity, temperature rating.

2. No. 10 AWG and smaller:

a. Insulated wire nut with locking spring type insert.

b. Solderless, long barrel compression type.

3. No. 8 AWG and larger:

a. Split bolt type.

PART 3 – EXECUTION

3.01 MINIMUM SIZES

A. Power and lighting circuits:

1. No. 12 AWG.

B. Control circuits:

1. No. 14 AWG.

C. Neutrals:

1. Equal to phase conductors.

3.02 INSTALLATION

A. All components of each designated conduit system shall be complete prior to pulling conductors.

B. Apply water soluble, Underwriters Laboratories listed pulling lubricant only as required and then as sparingly as possible; thereafter, thoroughly remove residual lubricant from accessible conductors within switchgear, switchboards, panelboards, junction boxes, pull boxes, wireways, etc.

C. Insulate connections with Underwriters Laboratories listed heat shrinkable insulators, molded composition covers and/or plastic tape.

D. Neatly train, lace and arrange conductors within panelboards, junction boxes, pull boxes, wireways, terminal cabinets, etc. to complement access and facilitate modifications.

END OF SECTION

SECTION 26 61 23

15 KV MEDIUM VOLTAGE CABLE

PART 1 – GENERAL

1.01 REQUIREMENTS

A. Furnish and install 15 KV medium voltage cables in accordance with the parameters shown on the drawings and herein specified.

B. Cable shall be the shielded, single conductor type; Underwriters Laboratories listed (components); complete with conductor, conductor shielding, insulation shielding and jacket.

C. Cable shall be UL type MV-105 that complies with UL1072, AEIC CS8 and ICEA S-93-639/NEMA WC74.

PART 2 – PRODUCTS

2.01 ACCEPTABLE MANUFACTERS

A. General Cable, Kerite, Okonite or approved equal.

2.02 DESCRIPTION

A. Conductor:

1. Class B, compressed or compact annealed bare copper strand.

B. Conductor shielding:

1. Extruded, conducting, thermosetting compound.

C. Insulation:

1. Ethylene-propylene-rubber (EPR).

2. 15,000 volts, 133% level for continuous operation at 105C.

D. Insulation shielding:

1. Free-stripping, extruded, conducting, thermosetting compound.

2. 5 mil helically applied, bare, copper shielding tape with a minimum of 20% overlap.

E. Jacket:

1. Sunlight resistant, polyvinyl chloride (PVC).

2. Surface (ink printed) identification (manufacturer, size, insulation type/thickness/voltage rating/level, date).

2.03 SPLICES AND TERMINATIONS

A. Materials shall be compatible with the cables being spliced and terminated, and shall be suitable for the prevailing environmental conditions..

B. In locations where moisture might be present, the splices shall be watertight. In manholes and pullboxes, the splices shall be submersible.

C. Splices:

1. Include all components required for complete splice, with detailed instructions.

D. Terminations::

1. Include shield ground strap for shielded cable terminations.

2. Class 1 terminations for indoor use:

a. Kit with stress-relief tube, nontracking, insulator tube, shield ground strap, compression-type connector, and end seal.

3. Class 3 terminations for outdoor use:

a. Kit with stress cone and compression-type connector.

4. Load-break terminations for indoor and outdoor use:

a. 200 A loadbreak premolded rubber elbow connectors with bushing inserts, suitable for submersible applications. Allow sufficient slack in medium-voltage cable, ground, and drain wires to permit elbow connectors to be moved to their respective parking stands.

5. Dead-break terminations for indoor and outdoor use:

a. 600 A deadbreak premolded rubber elbow connectors with bushing inserts, suitable for submersible applications. Allow sufficient slack in medium-voltage cable, ground, and drain wires to permit elbow connectors to be moved to their respective parking stands.

6. Ground metallic cable shields with a device designed for that purpose, consisting of a solderless connector enclosed in watertight rubber housing covering the entire assembly.

7. Provide insulated cable supports to relieve any strain imposed by cable weight or movement. Ground cable supports to the grounding system.

2.04 FIREPROOFING TAPE

A. Fireproofing tape shall be flexible, non-corrosive, self-extinguishing, arcproof, and fireproof intumescent elastomer. Securing tape shall be glass cloth electrical tape not less than 0.18 mm (7 mils) thick, and 19mm (0.75 inch) wide..

PART 3 – EXECUTION

3.01 INSTALLATION

A. All components of each designated conduit system shall be complete prior to pulling conductors.

B. Conduits shall be rodded and a mandrel and swab shall be drawn through before cables are pulled.

C. Apply water soluble, Underwriters Laboratories listed pulling lubricant only as required and then as sparingly as possible; thereafter, thoroughly remove residual lubricant from all accessible conductors within switchgear, pull boxes, etc.

D. Neatly train, lace and arrange conductors within switchgear, pull boxes, etc. to complement access and facilitate modifications.

3.02 FIREPROOFING

A. Cover all cable segments exposed in manholes and pullboxes with fireproofing tape.

B. Apply the tape in a single layer, wrapped in a half-lap manner, or as recommended by the manufacture. Extend the tape not less than 1 inch into each duct.

C. At each end of a taped cable section, secure the fireproof tape in place with glass cloth tape.

D. Neatly train, lace and arrange conductors within switchgear, pull boxes, etc. to complement access and facilitate modifications.

3.03 CIRCUIT IDENTIFICATION OF FEEDERS

A. In each manhole and pull box, install permanent tags on each circuit's cables to clearly designate the circuit identification, phase and voltage. The tags shall be the embossed brass type, 40 mm (1.5 inches) in diameter and 40 mils thick. Attach tags with plastic ties. Position the tags so they will be easy to read after the fireproofing tape is installed.

3.04 TESTING

A. Provide high potential testing in accordance with IEEE standards by a testing company approved by the college.

B. Submit results (in report form) to the Engineer and college within five working days of the test.

END OF SECTION

SECTION 26 61 30

RECEPTACLE, DEVICE, PULL AND JUNCTION BOXES

PART 1 – GENERAL

1.01 REQUIREMENTS

A. Furnish and install receptacle, device, pull and junction boxes in accordance with the parameters shown on the drawings and herein specified.

B. Units shall be sized in accordance with the guidelines set forth in the National Electrical Code (Article 370).

C. Units shall be Underwriters Laboratories listed.

PART 2 – PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Appleton, Raco, Steel City or approved equal.

2.02 DESCRIPTION

A. Interior, dry locations:

1. Cadmium plated, code gauge steel.

B. Exterior and interior, wet locations:

1. Cadmium plated cast alloy, threaded hubs, gasketed cover, stainless steel fasteners, NEMA 3R.

PART 3 – EXECUTION

3.01 INSTALLATION

A. Boxes shall be securely mounted to the building construction and shall not be supported by the associated conduit system.

B. Boxes shall be fully recessed, positioned level and plumb and properly aligned relative to the associated room finishes.

C. Actual locations shall be coordinated with other elements contributing to the aesthetics of the associated wall elevation (complete with complementary bar hangers as required.

D. Boxes serving two or more devices shall be the multiple gang type.

END OF SECTION

SECTION 26 61 33

ALUMINUM SURFACE RACEWAY

PART 1 – GENERAL

1.01 REQUIREMENTS

A. Furnish and install aluminum surface raceway system in accordance with the parameters shown on the drawings and herein specified.

B. Units shall be installed in accordance with the National Electrical Code (Article 352), Underwriters Laboratories listed UL5, ADA compliant, comply with TIA/EIA Telecommunications Standards, complete with fittings, boxes, devices and all accessories necessary for a complete system; additionally, Section 16141, *Receptacles and Switches*, shall apply.

PART 2 – PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Wiremold, AL5200 series or approved equal.

2.02 DESCRIPTION

A. Raceway:

1. 2-piece, aluminum multi-channel base, adjustable snap in divider , (designed for power, low voltage, data and communication wiring), aluminum snap-on cover.

B. Base:

1. Heave #6063-T5 extruded aluminum, satin anodized finish, 0.080” wall.

C. Cover:

1. Heavy #6063-T5 extruded aluminum, satin anodized finish, 0.75” wall thickness.

D. Fittings:

1. 2 inch cable bend radius (minimum) to meet specifications for fiber optic and Category 5 cabling.

2. Elbows, tees, entrance end fittings, conduit adapters, splice covers, end caps, wire clips, cover plates, etc. as required.

E. Device brackets and face plates:

1. High impact plastic, overlap raceway cover (seamless transition), allows mounting of standard devices in-line, up to 4 single-gang plates shall fit flush in device plate.

F. Communications devices and accessories:

1. Connectivity outlets, modular inserts, faceplates and bezels for UTP (Category 6), STP (Category 6), fiber optic and coaxial cable as shown or noted.

PART 3 – EXECUTION

3.01 INSTALLATION

A. Fittings shall overlap the cover and base to hide any uneven cuts.

B. Provide wire clips at 48 inches on-center to support wires and cables within the raceway.

C. Raceway shall be securely mounted to the building construction with steel fasteners and shall not be supported by the associated conduit system.

D. Raceway shall be surface mounted, positioned level and plumb and properly aligned relative to the associated room finishes.

E. Actual locations shall be coordinated with other elements contributing to the aesthetics of the associated wall elevation.

END OF SECTION

SECTION 26 61 40

RECEPTACLES AND SWITCHES

PART 1 – GENERAL

1.01 REQUIREMENTS

A. Furnish and install receptacles and switches in accordance with the parameters shown on the drawings and herein specified.

B. Units shall be Underwriters Laboratories listed.

PART 2 – PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. General Electric, Hubbell, Leviton, Pass & Seymour or approved equal.

2.02 DESCRIPTION

A. Receptacles:

1. General:

a. Classification:

1) Specification grade, extra hard use.

b. Arrangement:

1) 2-pole, 3-wire.

c. Construction:

1) High impact thermoplastic (nylon) face, thermoplastic back body.

d. Contacts:

1) Triple wipe, T-slot, one-piece copper alloy.

e. Strap:

1) Wraparound, securely interlocked, receptacle box grounding clip.

2. General purpose type:

a. 20 ampere, 125 volts, NEMA configuration 5-20R, back and side wired, white.

b. Pass & Seymour 5362 Series.

3. Ground fault circuit interrupter (self-test) type:

a. 20 ampere (feed-through), 125 volts auto-ground, self-test, indicator light, NEMA configuration 5-20R, side-wired, color selected by architect.

b. Pass & Seymour 2097 Series.

4. Ground fault circuit interrupter/weather-resistant (self-test) type:

a. 20 ampere (feed-through), 125 volts, auto-ground, self-test, indicator light, Safelock, NEMA configuration 5-20R, back or side-wired, white.

b. Pass & Seymour 2097TRWR Series.

5. Transient voltage surge suppressor type:

a. 20 amp, 125 volts, hospital grade, NEMA configuration 5-20R, back and side wired, MOV surge protection of 210 joules in three modes, 500V nominal let-through (suppressed) in three modes, RFI and EMI noise filtration of 7:1 reduction, audible alarm with LED monitor light, color selected by architect.

b. Pass & Seymour 8200-ISP Series.

6. USB chargers type:

a. 20 ampere, 125 volts, NEMA configuration 5-20R, back and side wired, thermoplastic tamper resistant black "invisis-shutters", one usb type a port and one usb type c port, color selected by architect.

b. Pass & Seymour TR20USBAC series.

B. Switches:

1. General:

a. Classification:

1) Specification grade, hard use.

b. Construction:

1) Arc resistant thermoset material body, thermoplastic polycarbonate toggle switch handle, heavy duty mounting strap.

c. Operating components:

1) Oversize silver alloy contacts, heavy gauge one-piece bronze alloy contact arm, cam (fast "make" and positive "break" response), heavy duty (quiet operation) bumper pads.

2. General purpose type:

a. 20 ampere, 120/277 volts, back and side wired, white.

b. Pass & Seymour CSB20AC Series.

C. Wall plates:

1. Interior:

a. Type 302/304 stainless steel, satin finish in all lab areas.

b. Thermoplastic, high impact, self-extinguishing nylon, smooth finish, white in classrooms, offices and ancillary spaces.

1. Pass & Seymour TP Series.

2. Exterior:

a. UV stabilized high impact polycarbonate, while-in-use, gasket, wet location, extra-duty application, NEMA 3R, opaque gray.

b. Intermatic WP5000 Series.

PART 3 – EXECUTION

3.01 INSTALLATION

A. Wall plates serving 2 or more devices shall be the multiple gang type.

B. Orientation:

1. Receptacles:

a. Vertical (whenever possible).

b. Ground outlet up.

2. Switches:

a. Toggle up when controlled device(s) is energized.

3.02 APPLICATION

A. Special purpose switches:

1. Pilot lighted type (toggle glows when controlled device(s) is energized):

a. When the controlled device(s) is not visible from the associated switch.

2. Lighted type (toggle glows when controlled device(s) is de-energized):

a. Mechanical equipment rooms.

3. Locking or security type (key operated):

a. Where noted.

B. Ground fault circuit interrupter type receptacles:

1. Provide ground fault circuit interrupter receptacles where indicated on the floor plans.

2. Provide ground fault circuit interrupter/weather resistant receptacles at the building exterior where indicated on the floor plans.

END OF SECTION

SECTION 26 61 42

HEAVY DUTY RETRACTABLE INDUSTRIAL CORD REELS

PART 1 – GENERAL

1.01 REQUIREMENTS

A. Furnish and install heavy duty retractable industrial cord reels in accordance with the parameters shown on the drawings and herein specified.

B. Units shall be Underwriters Laboratories listed, complete with fittings, boxes, devices, and all accessories necessary for a complete system; additionally, Section 266140/266141, Receptacles and Switches, shall apply.

PART 2 – PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Hubbell, KH Industries or approved equal.

2.02 DESCRIPTION

A. Construction:

1. All steel construction including mounting base, NEMA 2 rated for indoor use, 12 position adjustable guide arm, adjustable rachet that can be engaged (positive lock) or disengaged (constant tension) as needed, adjustable ball stop, powder coat finish as noted.

B. Power reel:

1. 50 feet of 125-volt 20-amp SJOW black cord (3 conductor, 12-gauge, 20 amp), NEMA 5-20R GFCI duplex receptacle.

C. Communication reel:

1. 50 feet of retractable premium 24 AWZG hi-flex tactical shielded CAT6 cable with 3-foot static male end, genuine Neutrik Ethercon connectors, bus drop grip installed near retractable connector end for strain relief, industrial spring motor for strong retraction with a 10,000-cycle rating (full deployment and retraction).

PART 3 – EXECUTION

3.01 INSTALLATION

A. Cord reels shall be securely mounted to the building construction with steel supports and steel fasteners as necessary and shall not be supported by building utilities.

B. Cord reels shall be surface mounted, positioned level and plumb and properly aligned relative to the associated room finishes.

C. Actual locations shall be field coordinated with actual equipment/device the cord reel is serving.

END OF SECTION

SECTION 26 61 70

SAFETY SWITCHES

PART 1 – GENERAL

1.01 REQUIREMENTS

A. Furnish and install safety switches in accordance with the parameters shown on the drawings and herein specified.

B. Units shall be the heavy duty type (single throw/double throw); Underwriters Laboratories listed.

PART 2 – PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Eaton, ABB, Siemens. Square D or approved equal.

2.02 DESCRIPTION

A. Enclosure:

1. NEMA classification:

a. No. 1 (unless otherwise noted).

2. Material:

a. Phosphatized, galvanized steel.

3. Finish:

a. Baked enamel.

B. Interior:

1. Arrangement:

a. Visible blades, front removable lugs, neutral and/or grounding kits (as required).

2. Construction:

a. Plated (corrosion resistant) current carrying components.

3. Fuse holders:

a. Spring loaded, rejection kit (for current limiting fuses).

C. Mechanism:

1. Operating handle:

    a. Integral with box (not cover), lockable in "On" and "Off" positions, indicative of switch ("On" – "Off") status (by virtue of position).

2. Action:

    a. Quick-make, quick-break (arranged to prevent operating handle induced restraint once contact movement is initiated), dual cover interlock, control circuit interlock.

END OF SECTION

SECTION 26 61 90

SUPPORTING SYSTEMS

PART 1 – GENERAL

1.01 REQUIREMENTS

A. Furnish and install supporting systems for conduit systems and equipment.

1.02 STANDARDS

A. Conduit system attachments, structural attachments, hanger rods, channels, fittings and hardware systems shall conform with the requirements set forth in the Metal Framing Manufacturers Association Standard Publication MFMA-1.

PART 2 – PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. B-Line, Erico, Kindorf, Superstrut, Unistrut or approved equal.

2.02 DESCRIPTION

A. Basic components (conduit system attachments, structural attachments, hanger rods, channels, fittings and hardware systems).

1. Stock, production units.

B. Finish:

1. Hot-dip, galvanized.

PART 3 – EXECUTION

3.01 INSTALLATION

A. Systems shall be capable of properly supporting each conduit system, including provisions for:

1. Expansion and contraction (movement shall not cause disengagement).

2. Preventing excessive stress.

3. Threaded vertical adjustment subsequent to installation.

B. Hanger rods shall be subjected to tensile loads only; where axial or lateral movements are anticipated, suitable linkages shall be provided.

C. Supporting systems shall be secured to the building structural system (as shown), NOT to ROOF decks or components of the mechanical and electrical systems

(ductwork, piping, conduit, etc.); however, attachments serving conduit 2 inches and smaller may be secured to FLOOR decks.

D. Conduit systems shall be independently supported from equipment, boxes, cabinets, etc.

E. Trapeze or other multi-conduit support arrangements shall be constructed to accommodate 25 percent additional conduits.

END OF SECTION

SECTION 26 62 04

EMERGENCY/STANDBY POWER SYSTEMS

PART 1 – GENERAL

1.01 REQUIREMENTS

A. Furnish and install emergency/standby power systems in accordance with the parameters shown on the drawings and herein specified.

B. Systems shall be the stationary, gaseous fuel engine driven alternator type; conform with the requirements set forth in NFPA 110; Underwriters Laboratories listed; factory assembled and wired (except for field wiring as shown and/or noted); prototype and production tested; mounted on a common, full length, heavy duty steel base with vibration isolation; complete with alternator, engine, remote radiator, automatic transfer switch, panel mounted operating and safety controls, remote annunciator panel, weather protective enclosure, special tools and spare parts, warranty, operation and maintenance manual(s), on-site testing and instruction.

1.02 SOURCE AND SERVICE

A. Source:

1. Basic systems components (alternator, engine, remote radiator and transfer switch) and associated accessories shall be furnished by a single manufacturer through a factory authorized distributor.

B. Service:

1. Systems service shall be available from the manufacturer's authorized distributor (located within a 100 mile radius) 24 hours of every day via qualified factory trained technicians.

1.03 WARRANTY

A. The system shall be warranted by the manufacturer to be free from defects in equipment, materials and workmanship for a period of 5 years from the date of final acceptance by the Owner, during which time all above mentioned defects shall be corrected and all services incidental to proper performance shall be provided free of charge.

PART 2 – PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Generac, Onan, Kohler, Catapillar or approved equal.

2.02 DESCRIPTION

A. Alternator:

1. General:

    a. Synchronous, 4-pole, revolving field, single bearing, directly driven via flexible steel disc(s), drip-proof, air cooled, field connection bus bars.

2. Armature (Stator):

    a. Electrical grade steel, skewed laminations, tightly secured windings.

3. Rotor:

    a. Layer wound, wedged field windings; dynamically balanced.

4. Exciter:

    a. Brushless, 3-phase, full wave silicon diodes, semi-conductor surge suppressors.

5. Voltage regulator:

    a. Solid state, permanent magnet generator excitation powered (for distortion immunity due to non-linear SCR controlled loads), overvoltage and over excitation protection, temperature compensated, 3-phase RMS sensing.

    b. Torque-matched underfrequency compensation (to optimize motor starting performance and provide engine related assistance during transient load conditions).

6. Output circuit breaker:

    a. Enclosure:

        1) NEMA 1 (mounted within engine/alternator enclosure).

    b. Type:

        1) Thermal-magnetic, molded case, common trip (auxiliary contacts to indicate "Open" or "Tripped" position).

    c. Arrangement:

        1) 3-pole; insulated, groundable neutral assembly with multiple lugs (bonded to generator frame).

        2) Ground fault current detection system (relay, sensor, self-powered, 600 volt class).

        3) Factory installed line side wiring, oversized junction box with factory installed wiring to facilitate field installed output wiring.

7. Performance parameters:

    a. Voltage regulation:

1) +/- 0.5 percent, constant load, no load to full load.

b. Frequency regulation:

1) Isochronous, steady-state, no load to full load.

c. Random voltage variation:

1) +/- 0.5 percent, constant load, no load to full load, constant ambient and operating temperature.

d. Random frequency variation:

1) +/- 0.25 percent, constant load, no load to full load, constant ambient and operating temperature.

e. One step loading/unloading voltage variation:

1) +/- 25 percent, 5-second recovery.

f. One step loading/unloading voltage variation:

1) +/- 3 Hz, 5-second recovery.

g. Harmonic distortion:

1) Less than 5 percent of rated voltage (L-N, L-L, L-L-L), for the sum of voltage waveform harmonics, less than 3 percent for any single harmonic voltage.

h. Telephone influence factor:

1) Less than 50 according to NEMA MG1-22.43.

B. Engine:

1. General:

a. 4-cycle, spark ignited natural gas fueled, liquid cooled.

b. Cast iron cylinder block, replaceable wet liners.

c. Forged steel crankshaft and connecting rods.

2. Speed control:

a. EFC electronic governor (magnetic pickup speed sensor, adjustable electronic control, integral fuel pump electric actuator) externally adjustable (isochronous to 5 percent droop).

3. Cooling system:

a. Skid mounted remote radiator, independent dual circuit series arranged heat transfer surface (low temperature after cooling, jacket water), 30% propylene glycol solution.

b. Belt driven, statically and dynamically balanced axial flow fan, vibration isolation, guards.

c. Designated engine driven circulating pumps.

d. Thermostatic mixing valve temperature control, immersion heaters.

4. Exhaust silencer(s):

a. Critical type, flexible connectors.

5. Starting system:

a. Batteries:

1) Heavy duty (3, 30-second cranking cycles), lead-calcium, rack, cable, connectors.

b. Battery chargers:

1) During standby:

a) General:

(1) Voltage regulated; float, taper and equalize operation settings.

b) Indication (LED and contacts for remote annunciation):

(1) Commercial power failure (RED).

(2) Low battery voltage (RED).

(3) High battery voltage (RED).

(4) Power on (GREEN, no contacts).

2) Engine/Alternator operating:

a) Integral, engine driven.

6. Lubricating system:

a. Pump:

1) Mechanical, full pressure, positive displacement type.

b. Filter(s):

1) Full-flow, replaceable spin-on canister type.

7. Air cleaner:

a. Dry type, replaceable element, monitored restriction indicator.

C. Automatic transfer switch:

1. General:

a. Double throw contactor type, 100 percent continuous rating, 60 Hz, 600 vac.

b. Control logic possessive.

2. Construction:

a. Contacts:

1) High-pressure silver alloy, arc chutes with insulating covers, metal leaves.

b. Lugs:

1) Commercial, emergency, load (including full size neutral); designed for field adaptation.

c. Manual operating handle:

1) Quick-break, quick-make, suitable for manual operation under load.

d. Interlock:

1) Positive electrical and mechanical arrangement, designed to prevent simultaneous closing (break before make), mechanically held (commercial and emergency positions).

e. Cabinet:

1) Enclosure:

a) NEMA 1, arranged to conceal manual operating handle and control switches.

2) Door:

a) General:

(1) Piano hinge, key locking.

b) Indication (lamps):

(1) Commercial, WHITE.

(2) Emergency, AMBER.

(3) Commercial available, GREEN.

(4) Emergency available, RED.

c) Key-operated selector switch:

(1) Test.

(2) Commercial.

(3) Retransfer.

3. Controls:

a. General:

1) Modular, solid state.

2) Designed to obviate transient influences, AC input isolation transformers, output relays.

b. Undervoltage sensors:

1) Normal and emergency source monitoring (all phases), adjustable pickup and dropout settings, fixed dropout time delay, temperature compensated.

c. Overvoltage and underfrequency sensors:

1) Adjustable pickup and dropout settings, adjustable time delay.

4. System operation:

a. General:

1) System control arrangement shall permit manual operation.

2) Emergency system shutdown through air supply damper or fuel line solenoid actuation shall be manually initiated via an "emergency stop" (push button) switch with manual reset.

3) Should the system fail while servicing the associated load, retransfer to commercial power shall occur instantaneously whenever all phases reach 90 percent of their normal steady-state characteristics.

4) System shall automatically shut down and lock out in response to overcrank, overspeed, low lubricating oil pressure, high engine temperature and low coolant level.

b. Actuation:

1) System engine shall start automatically subsequent to an adjustable (30-120 seconds) time delay to avoid transient condition actuation whenever any phase of the associated commercial power supply voltage falls below 85 percent of its normal steady-state characteristics.

c. Transfer (commercial to emergency):

1) System shall transfer automatically from commercial to emergency power following an adjustable (30-120 seconds) engine warm-up time delay and a subsequent adjustable (0-7.5 seconds) neutral position time delay to insure system induced voltage decay.

d. Retransfer (emergency to commercial):

1) System shall transfer automatically from emergency to commercial power following an adjustable (0-7.5 seconds) neutral position time delay to insure distribution system induced voltage decay whenever all phases of the associated commercial power supply voltage have returned to 93 percent of their nominal steady-state characteristics for an adjustable (15-30 minutes) continuous time period to insure stability.

e. Shutdown:

1) Subsequent to retransfer, the system engine shall continue to operate for a 5-minute "cool-down" period; whereafter, it shall shut down automatically.

D. Control panel (engine/alternator):

1. General:

a. NEMA 1 enclosure, solid state, vibration isolators, surge suppression protection, "Run-Stop-Auto" selector switch, monitor reset and lamp test switch, molded case circuit breaker.

b. Starting battery(ies) power supply, shutdown and lockout circuits independent of indication and pre-alarm circuits, indication relay contacts for remote annunciation, common alarm contact for remote audible interface.

2. Monitoring (indication lights):

a. Overcrank, RED.

b. Overspeed, RED.

c. Low lubricating oil pressure, RED.

d. High engine temperature, RED.

e. Low lubricating oil pressure pre-alarm, YELLOW.

f. High engine temperature pre-alarm, YELLOW.

g. System running, GREEN.

h. Selective switch not in auto position, flashing RED.

i. Low coolant temperature, YELLOW.

j. Low fuel, YELLOW.

k. Auxiliary, (2) RED.

3. Instrumentation:

a. Running time meter.

b. Analog AC voltmeter (dual range, 90° scale, 2% accuracy).

c. Analog AC ammeter (dual range, 90° scale, 2% accuracy).

d. 7-position phase selector switch ("Off"; position, current and voltage, each phase).

e. Voltage adjustment rheostat (+/- 5%).

f. Analog frequency meter (45-65 Hz, 90° scale, +/- 0.60 Hz accuracy).

g. DC voltmeter.

h. Wattmeter (90° scale).

i. Lubricating oil pressure gauge.

j. Coolant temperature gauge.

E. Remote annunciator panel:

1. General:

a. NEMA 1 enclosure, stainless steel front panel, wall mounted.

b. Solid state, battery powered, light emitting diode (LED) lamps, lamp test switch.

c. Audible alarm silence button (arranged to reset for subsequent fault regardless of prior fault status).

d. Common alarm contact for remote interface.

2. Indication (lamps):

a. High battery voltage, RED.

b. Low battery voltage, RED.

c. Normal battery voltage, GREEN.

d. Utility in-service, GREEN.

e. E/A operating, GREEN.

f. E/A in-service, GREEN

g. Low lubricating oil pressure pre-alarm, YELLOW.

h. Low lubricating oil pressure, RED.

i. High engine temperature pre-alarm, YELLOW.

j. High engine temperature, RED.

k. Low engine temperature, RED.

l. Overcrank, RED.

m. Overspeed, RED.

n. Selector switch not in auto position, flashing RED.

o. Battery charger malfunction, RED.

p. Low fuel pressure, RED.

3. Audible:

a. Low lubricating oil pressure pre-alarm.

b. Low lubricating oil pressure.

c. High engine temperature pre-alarm.

d. High engine temperature.

e. Low engine temperature.

f. Overcrank.

g. Overspeed.

h. Selector switch not in auto position.

i. Low fuel pressure.

F. Weather protective enclosure:

1. Walls:

a. Reinforced, formed, 14-gauge galvanized steel.

2. Roof:

a. Reinforced, galvanized steel.

b. Designed to complement silencer support and mounting.

3. Doors:

a. Piano hinge; flush mounted, adjustable, keylock latches.

b. Arranged (size and location) to complement maintenance and operation.

4. Louvers:

a. General:

1) Weather resistant (low-leakage), motor operated, bird screen.

2) Arranged (size and location) to complement maintenance and operation.

b. Operation:

1) Intake:

a) Normally open, 2-position, spring return.

2) Discharge:

a) Normally open, modulating (in response to coolant temperature).

5. Finish:

a. 2 coats, rust inhibiting primer.

b. 2 coats, baked enamel.

6. Accessories:

a. Safeing:

1) All penetrations.

b. Electrical:

1) Lighting (arranged to facilitate maintenance).

2) Receptacle (120/1/60, 20A, duplex, GFCI).

3) Panelboard (120/280V-3Ø-4W, 100 amp mains, circuit breakers as required).

c. Piping:

1) Oil and water drain extensions.

G. Special tools and spare parts:

1. Special tools:

a. One set (for normal maintenance), storage case.

2. Spare parts:

a. One set:

1) Filter elements (air, lubrication); fan belts; fuel and lubricating oil hoses, clamps and fittings; indicating lamp jewels.

b. Two sets:

1) Indicating lamps.

PART 3 – EXECUTION

3.01 OPERATION AND MAINTENANCE MANUALS

A. Provide 3, neatly bound, indexed, manuals complete with:

1. Descriptive literature.

2. Dimensional drawings.

3. Schematic diagrams.

4. Wiring diagrams.

5. Operating instructions.

6. Maintenance procedures.

7. Troubleshooting guides.

8. Parts listings.

9. Service sources (names, addresses and telephone numbers).

B. Thoroughly review manuals with the Owner's authorized representative(s) to assure their familiarity and understanding.

3.02 ON-SITE TESTING

A. General:

1. With the system installation complete, factory trained technicians (representatives of the manufacturer's authorized distributor) shall perform operational testing which shall include:

a. Manufacturer prescribed requirements.

b. Owner requirements.

2. All evident defects shall be corrected and services incidental to insuring proper performance shall be provided without charge.

B. Owner requirements:

1. General:

a. Testing shall be conducted in the presence of the Owner's authorized representative(s).

b. A dual procedure shall be employed:

1) Simulated circumstances (prior to executing terminations at the automatic transfer switch) utilizing a load bank complete with all necessary temporary wiring.

2) Actual operating conditions created by de-energizing the commercial power supply.

2. Simulated testing:

a. Continuous operation, 4-hour duration.

b. First hour:

1) 50 percent of continuous standby rating, unity power factor.

c. Second through fourth hour:

1) 100 percent of continuous standby rating, unity power factor.

d. Subsequent cool-down period:

1) No load, 10-minute duration.

e. Recorded requirements (5-minute intervals for 30 minutes; 15-minute intervals thereafter):

1) Ambient air temperature.

2) Coolant temperature.

3) Lubricating oil pressure.

4) Frequency.

5) Voltage.

6) Current.

7) Power factor.

8) Output power.

3. Operating condition testing:

a. Verify phasing of commercial and emergency power supplies at automatic transfer switch.

b. 2-hour duration, beginning from "cold start" condition.

c. De-energize commercial power supply, observe system operation.

d. Restore commercial power supply, observe system operation.

3.03 INSTRUCTION

A. Provide thorough demonstrative instruction (2, 4-hour sessions) via factory trained technicians (representatives of the manufacturer's authorized distributor); secure the Owner's written acknowledgement and submit to the Engineer.

END OF SECTION

SECTION 26 62 64

3-WAY MANUAL TRANSFER SWITCH

PART 1 – GENERAL

1.01 REQUIREMENTS

A. Furnish and install 3-way manual transfer switches (MTS) in accordance with the parameters shown on the drawings and herein specified.

B. 3-way manual transfer switches and controls shall conform to the requirements of:

1. UL 1008, *Standard for Transfer Switch Equipment*.

2. NFPA 70, *National Electrical Code*.

1.02 SOURCE AND SERVICE

A. Source:

1. Automatic transfer switch and associated accessories shall be furnished by a single manufacturer through a factory authorized distributor.

B. Service:

1. Systems service shall be available from the manufacturer's authorized distributor 24 hours of every day via qualified factory trained technicians.

1.03 GUARANTEE

A. The system shall be guaranteed to be free from defects in materials and workmanship for a period of one year from the date of final acceptance by the Owner, during which time all above mentioned defects shall be corrected and all services incidental to proper performance shall be provided free of charge.

PART 2 – PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. ELS Power Systems, Inc. or approved equal.

2.02 DESCRIPTION

A. General:

1. The 3-way manual transfer switch shall consist of two mechanically interlocked molded case circuit breakers, one independent load bank breaker with a shunt-trip, male cam-style inlet connectors, female cam-style outlet connectors, power distribution blocks and grounding terminals, all housed within a pad lockable enclosure.

B. Enclosure:

1. NEMA classification:

a. Type 3R.

b. Interlocked, hinged, full height door.

c. Drawn flange cable entry openings in the bottom of the enclosure.

d. Hinged flap door to cover unused cable openings.

2. Material:

a. Continuous seam-welded galvanneal steel.

3. Finish:

a. Powder coat after fabrication.

C. Molded case circuit breakers:

1. Trip rating as noted on the documents.

2. Door mounted operating mechanisms preventing the opening of the main access door unless all three breakers are in the "off" position.

3. Mounted behind a deadfront panel.

4. Load-side shall not be energized unless the main access door is closed and one of the breakers is in the "on" position.

5. The two units controlling the connections between the permanent generator and the automatic transfer switch, and the connection between the portable generator and automatic transfer switch shall be safety interlocked by mechanical means to ensure only one of these breakers can be closed at any given time.

6. One unit shall control the connection between the permanent generator and the automatic transfer switch.

7. Second unit shall control the connection between the permanent generator and the load bank female cam-style connectors.

8. Third unit shall control the connection between the portable generator (via male cam-style connectors) and the automatic transfer switch.

D. Power distribution block:

1. Provided for load side wiring.

2. Factory wired to molded case circuit breakers.

E. Auxiliary contacts:

1. Three per molded case circuit breaker, factory wired to terminal blocks.

   a. Activate an annunciator circuit.

   b. Activate low voltage generator start signal.

   c. Spare or as noted on documents.

PART 3 – EXECUTION

3.01 ON-SITE TESTING

A. Prior to energizing 3-way manual transfer switch, the electrical contractor shall perform the following checks and tests:

   1. Verify mounting and connections are complete and secure.

   2. Verify internal components and wiring are secure.

   3. Perform continuity check of all circuits.

   4. Perform 1,000 VDC megger test on feeder, load and ground cables.

   5. Verify deadfront is secure.

   6. With the 3-way manual transfer switch deadfront in place and the main access door closed and properly latched, actuate all three Operator Mechanisms; verify:

      a. With the breaker controlling the connection between the permanent generator and the automatic transfer switch (ATS) in the "ON" position, the breaker controlling the connection between the permanent generator and the load bank can be turned to the "ON" and "OFF" position and the breaker controlling the connection between the portable generator and the automatic transfer switch cannot be turned "ON."

      b. With the breaker controlling the connection between the permanent generator and the automatic transfer switch (ATS) in the "OFF" position, the other two breakers controlling the connection between the permanent generator and the load bank can be turned can be turned "ON" or "OFF", and the breaker controlling the connection between the portable generator and the automatic transfer switch can be turned "ON" and "OFF".

      c. With the breaker controlling the connection between the portable generator and the automatic transfer switch (ATS) in the "On" position, the breaker controlling the connection between the permanent generator and the automatic transfer switch (ATS) cannot be turned "ON" and the breaker controlling the connection between the permanent generator and load bank can be turned "ON" and "OFF."

7. Confirm operation of the 3-way manual transfer switch ground receptacle by attaching a plug to the 3-way manual transfer switch ground receptacle and then verify that the plug is grounded to the facility ground.

8. Once normal power has been applied, confirm operation of 3-way manual transfer switch by following directions on main access door.

3.03 INSTRUCTION

A. Provide thorough demonstrative instruction (2-hour session) via factory trained technicians (representatives of the manufacturer's authorized distributor); secure the Owner's written acknowledgement and submit to the Engineer.

END OF SECTION

SECTION 26 64 60

DRY TYPE TRANSFORMERS, 600 VOLTS MAXIMUM

PART 1 – GENERAL

1.01 REQUIREMENTS

A. Furnish and install dry type transformers in accordance with the parameters shown on the drawings and herein specified.

B. Units shall be the general purpose, high-efficiency type; designed, constructed and tested in accordance with ANSI/IEEE Standards; NEMA TR1 noise generation compatible with United States Department of Energy (DOE) "DOE 2016" compliant; Underwriters Laboratories K factor listed for non-linear loading; complete with enclosure, core, windings, load taps, grounding provisions and accessories.

1.02 DOCUMENTATION

A. Drawings:

1. Plan, elevations, installation clearances.

2. Mounting details.

3. Conduit entrance location/size.

4. Ground location.

5. Accessories.

6. Weight.

B. Operating and maintenance manual.

C. Parts list.

D. Certified test report.

E. Short circuit withstand capacity.

F. Maximum impedance variation.

1.03 WARRANTY

A. Units shall be complete with a 1-year material and workmanship warranty.

PART 2 – PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Eaton,Cutler-Hammer, General Electric, Square D or approved equal.

2.02 DESCRIPTION

A. Enclosure:

1. Heavy gauge steel.

2. Ventilation openings, large cable space.

3. Electrostatic gray enamel finish.

B. Core:

1. High grade, grain oriented, silicon steel laminations, step-lap mitered joints.

2. High magnetic permeability, high differential magnetic flux density/saturation point.

3. Clamped, braced.

C. Windings:

1. Tightly wound copper, 115C temperature rise.

2. Epoxy coated insulation system, 200C.

3. External short-circuit braced, above rated voltage/below rated frequency capacity.

D. Load taps:

1. Above/below normal voltage.

E. Non-linear loading characteristics:

1. K factor as scheduled.

2. 2:1 neutral bus/secondary phase conductors ampacity.

3. Full length copper electrostatic shield.

F. Accessories:

1. Wall mounting brackets.

2. Weathershield kit.

PART 3 – EXECUTION

3.01 FIELD CHECKING START-UP

A. Unit field checking, adjustments, testing, and start-up (including verbal operating instruction as required and requested by the Owner's authorized representative)

shall be performed by the manufacturer's factory trained technicians, with a copy of the results (in report form) submitted to the Engineer.

END OF SECTION

SECTION 26 64 62

PAD MOUNTED DISTRIBUTION TRANSFORMERS

PART 1 – GENERAL

1.01 REQUIREMENTS

A. Furnish and install pad mounted, dead front, compartmental type (high and low voltage) transformers in accordance with the parameters shown on the drawings and herein specified.

B. Units shall be the liquid filled type; designed, constructed and tested in accordance with ANSI/IEEE Standards; NEMA TR1 noise generation compatible; complete with tank, core, windings, bushings, arresters, insulating fluid, cooling system, grounding provisions, tap changer, exterior finish and accessories.

C. Factory mutual (FM) approved for installation near or inside buildings.

1.02 DOCUMENTATION

A. Drawings:

1. Plan, elevations, access openings, maintenance clearances.
2. Bushing details.
3. Anchoring details.
4. Conduit entrance location/size.
5. Ground pad locations.
6. Accessories.
7. Major components weight, insulating fluid volume.

B. Wiring diagrams:

1. Interconnecting wiring (devices and accessories).
2. Terminal block identification.

C. Operating and maintenance manual.

D. Parts list.

E. Certified test report.

F. Short circuit withstand capacity.

G. Maximum impedance variation.

1.03 WARRANTY

A. Units shall be complete with a 5-year material and workmanship warranty.

PART 2 – PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. ABB, Cooper Power Systems, Cuttler-Hammer or approved equal.

2.02 DESCRIPTION

A. Tank:

1. Full vacuum compatible, sufficient expansion volume.

2. Welded cover, bolted access openings.

3. Base, lifting lugs, jacking pads, pulling provisions.

4. Constructed to withstand 7 psi without permanent deformation and 15 psi without rupture.

5. 15 psig pressure relief valve, 35 scfm (min.).

B. Core:

1. High grade, grain oriented, silicon steel laminations, step-lap mitered joints.

2. High magnetic permeability, high differential magnetic flux density/saturation point.

3. Clamped, braced, welded construction.

C. Windings:

1. Tightly wound aluminum.

2. Epoxy coated, dual sheet insulation (each layer).

3. Secondary winding sheet conductor.

4. External short-circuit braced, above rated voltage/below rated frequency capacity.

D. Bushings:

1. High voltage, low voltage.

2. Gray wet-process porcelain (above 600 volts).

E. Arrestors:

1. Primary:

a. Distribution class.

2. Secondary:

a. Distribution class.

3. Close bushing proximity.

F. Insulating fluid:

1. Envirotemp FR3.

2. Compatible gaskets.

3. Biodegradable, natural ester based, edible seed oils, food grade performance enhancing additives.

G. Cooling system:

1. Rigidly supported heat transfer surface.

2. Self-cooled.

H. Grounding provisions:

1. Dual, welded pads.

2. Dual, copper clad tappings.

I. Tap changer:

1. Manual, de-energized operation.

2. Full capacity, gang operated.

J. Exterior finish:

1. Cleaned, phosphortized.

2. Corrosion inhibiting primer, finish coat.

K. Primary connections:

1. 200 amp, deadfront, load break.

L. High voltage switching:

1. Internal, 4-position V-blade, insulating fluid immersed, gang operated, rotary, load break switch.

2. Continuous current 200 amperes, momentary current 10,000 amps symmetrical (2 seconds).

M. Primary fusing:

1. Oil immersed, load break bay-o-net overload sensing fuses in series with under oil partial range current limiting fuses.

N. Accessories:

1. Dial type thermometer.
2. Liquid level gauge.
3. Pressure-vacuum gauge.
4. Drain valve with sampler valve.
5. Pressure relief valve.
6. Upper fill/filter press connection or valve.
7. Alarm contacts.
8. Rapid pressure rise relay.
9. Winding temperature relay.
10. Gas sampling valve.
11. Welded main tank cover with bolted manhole.
12. Danger high voltage warning signs.

PART 3 – EXECUTION

3.01 FACTORY TESTING AND TOLERANCES

A. All units shall be tested for the following:

1. No-load (85°C or 20°C) losses at rated current.
2. Total (85°C) losses at rated current.
3. Percent impedance (85°) at rated current.
4. Excitation current (100% voltage) test.
5. Winding resistance measurement tests.
6. Ratio tests using all tap settings.
7. Polarity and phase relation tests.
8. Induced potential tests.
9. Full wave and reduced wave impulse test.

3.02 FIELD CHECKING START-UP

A. Unit field checking, adjustments, testing, and start-up (including verbal operating instruction as required and requested by the Owner's authorized representative) shall be performed by the manufacturer's factory trained technicians, with a copy of the results (in report form) submitted to the Engineer.

END OF SECTION

SECTION 26 64 70

DISTRIBUTION SWITCHBOARDS

PART 1 – GENERAL

1.01 REQUIREMENTS

A. Furnish and install distribution switchboards in accordance with the parameters shown on the drawings and herein specified.

B. Systems shall be the modular, free-standing type; Underwriters Laboratories listed; factory assembled and wired (except for field wiring as shown and/or noted); have an interrupting capacity rating equal to the lowest device (switchboard/circuit breakers); arranged to complement convenient expansion; complete with vertical sections, bus bars, main (incoming) device(s), feeder (outgoing) device(s), metering, ancillary wiring (interconnection, metering, control) and accessories.

PART 2 – PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Cutler-Hammer, ABB, I.T.E., Square D., Westinghouse or approved equal.

2.02 DESCRIPTION

A. Vertical sections:

1. NEMA classification:

a. No. 1 (unless otherwise noted).

2. Construction:

a. Reinforced, gusseted, bolted structural member support; bolted covers (sides, top, rear), lifting plates or beams (as required).

3. Finish:

a. Baked enamel (cleaned, rinsed, phosphatized, prepaint rinsed, painted, postpaint rinsed, baked, cool-down).

B. Bus bars:

1. Material:

a. Bolted, tin-plated, copper.

2. Arrangement:

a. Phase (A-B-C configuration: Left-to-right, top-to-bottom, front-to-rear), neutral (full size) and ground; horizontal and vertical; isolated/insulated.

b. Full length (including provisions for future devices), split (as required), splice bars, insulated support, incoming stub connectors (as applicable).

c. Sized according to a current density of 750 amperes per square inch of cross section, equivalent to the frame size rating of main (incoming) device (as applicable).

d. Terminations (incoming/outgoing):

1) Less than 100,000 amperes IC:

a) Mechanical type lugs.

2) Greater than 100,000 amperes IC:

a) Compression type lugs.

3. Barriers:

a. Insulated (sub-dividing vertical sections).

C. Main (incoming) device(s):

1. Arrangement:

a. Individually mounted, stationary, bolted access cover(s).

2. Type:

a. Maintainable, low voltage, power break.

b. Programmable microprocessor.

D. Feeder (outgoing) device(s):

1. Arrangement:

a. Group mounted, externally accessible operation (unless otherwise noted), front accessible wiring gutters, bolted access covers.

2. Type:

a. Thermal-magnetic, molded case, bolt-on.

3. Mechanism:

a. Operating handle:

1) Integral crossbar (to insure simultaneous response of multiple pole circuits), positive indication ("On"-"Off"-"Tripped").

b. Action:

1) Quick-make, quick-break.

4. Marking:

a. Single pole, 15A and 20A:

1) SWD.

b. Multiple pole, 15A to 100A:

1) HACR.

E. Customer metering:

1. Designated compartment(s), insulated barriers, hinged door (lockable and sealable).

2. Programmable microprocessor.

3. True RMS technology current sensors.

4. Multi-button keypad, high contrast, liquid crystal display:

a. Current, RMS, (+/-) 2.0%.

b. Voltage, RMS, (+/-) 1.5%.

c. Energy, kwh/mwh/gwh, (+/-) 3.5%.

d. Demand, kw/mw/gw, adjustable time period, (+/-) 3.5%.

e. Peak demand, kw/mw, (+/-) 3.5%.

f. Real power, kw/mw, (+/-) 3.5%.

g. Total power, kva/mva, (+/-) 3.5%.

h. Frequency, Hz, (+/-) 1 Hz.

5. Ancillaries:

a. Integral test jack (battery pack/test kit interface).

b. Long life lithium batteries (supporting programming/observation when unit is de-energized); automatic, time delay shutoff.

F. Ancillary wiring:

1. Material:

a. #14, SIS.

2. Arrangement:

a. Horizontal (top)/vertical troughs.

3. Terminal blocks:

a. Heavy duty, one piece, molded plastic, 600 vac, 50A.

b. Numbering strips.

c. Cable compartment mounted, remote from cable terminals/line side disconnects, bolted steel covers.

4. Identification:

a. Marking sleeves.

b. Heat stamped, "Origin"/"Destination".

G. Accessories:

1. Control circuit transformer.

2. Hinged gutter covers.

PART 3 – EXECUTION

3.01 INSTALLATION

A. Set and secure units level and plumb on 4 inch high, concrete housekeeping pads.

B. Arrange (as shown) and install capacitors (as applicable).

C. Neatly train, lace and arrange cabling and control wiring to complement access and facilitate modifications.

3.02 IDENTIFICATION

A. Units shall be identified with engraved, phenolic nameplates indicating:

1. Distribution switchboard alphanumerical designation, characteristics and power source (switchgear, unit sub-station, distribution switchboard, etc.) and location (1 inch letter size); example:

SB-4
480Y-277V
PS: SG-A, BASEMENT, ROOM 46

2. Compartment(s) and feeder (outgoing) device(s) alpha-numeric designation (1/2 inch letter size); example:

CAPACITOR #1
DP-6A
P-4B
HVACU-3F

END OF SECTION

SECTION 26 64 71

PANELBOARDS

PART 1 – GENERAL

1.01 REQUIREMENTS

A. Furnish and install branch circuit and distribution panelboards in accordance with the parameters shown on the drawings and herein specified.

B. Units shall be the circuit breaker type; Underwriters Laboratories listed; service entrance labeled, as applicable; have an interrupting capacity rating equal to the lowest device (panelboard/circuit breakers); complete with enclosure, bus bar assemblies and circuit breakers.

PART 2 – PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Eaton, ABB, Siemens, Square D or approved equal.

2.02 DESCRIPTION

A. Enclosure:

1. NEMA classification:

a. No. 1 (unless otherwise noted).

2. Front:

a. Arrangement:

1) Dead front, hinged (to conveniently expose gutters).

2) Hinged door.

b. Door:

1) Flush cylinder type lock (keyed alike), 2 keys, spring-loaded stainless steel door pull.

2) Circuit directory.

c. Finish:

1) Baked enamel.

3. Back-box:

a. Recessed:

1) Phosphatized, galvanized steel.

b. Exposed:

1) Steel, removable endwalls.

2) Baked enamel finish.

B. Bus bar assemblies:

1. Construction:

a. Plated (corrosion resistant) copper bus, insulated bus structure.

2. Arrangement:

a. Bolt-on breaker compatible, phase sequenced.

C. Circuit breakers:

1. Type:

a. Thermal-magnetic, molded case, bolt-on.

2. Mechanism:

a. Operating handle:

1) Integral crossbar (to insure simultaneous response of multiple pole circuits), positive indication ("On"-"Off"–"Tripped").

b. Action:

1) Quick-make, quick-break.

3. Marking:

a. Single pole, 15A and 20A.

1) SWD.

b. Multiple pole, 15A to 100A:

1) HACR.

PART 3 – EXECUTION

3.01 INSTALLATION

A. Stub spare conduits in an accessible location above suspended ceiling systems for each recessed unit:

1. Branch circuit panelboard:

a. Four 3/4 inch.

2. Distribution panelboard:

a. Two 1-1/4 inch, one 2 inch.

B. Unit directories shall provide a typewritten account of branch circuit and distribution feeder loads by using the appropriate alphanumerical designations shown on the drawings and by illustrating the precise lighting fixture and receptacle arrangement.

3.02 IDENTIFICATION

A. Units shall be identified with engraved, phenolic nameplates indicating:

1. Branch circuit panelboard alphanumerical designation, characteristics and power source (branch circuit panelboard, distribution panelboard, distribution switchboard, etc.) and location (1/2 inch letter size); example:

P-1A
208Y/120V
PS: DP-2A, 2ND FL, ROOM 242

2. Distribution panelboard alphanumerical designation, characteristics and power source (distribution panelboard, distribution switchboard, unit substation, etc.) and location (3/4 inch letter size); example:

DP-2C
480Y/277V
PS: SB-1A, 1ST FL, RM 119

END OF SECTION

SECTION 26 65 11

INTERIOR LIGHTING FIXTURES (LED)

PART 1 – GENERAL

1.01 REQUIREMENTS

A. Furnish and install interior lighting fixtures in accordance with the parameters shown on the drawings and herein specified.

B. Units shall be Underwriters Laboratories listed; complete with housing, door/frame, lens, LED modules, LED driver and accessories.

C. Units shall be tested to IESNA LM-79 and LM-80.

D. Units shall have designs lights consortium approval.

1.02 SUBMITTALS

A. Fixture submittals shall be tendered in bound form (booklet, ring binder, etc.) with a designated, indexed section for each type.

B. Fixture descriptions shall include:

1. Alphanumeric designation (matching bidding documents) and corresponding generic description.

2. Product literature (including that for associated ballasts and lamps), edited and highlighted to indicate all parameters set forth in the bidding documents.

3. Photometric data.

4. Dimensioned drawings.

5. IESNA TM21-11 DATA.

1.03 WARRANTY

A. The system shall be warranted by the manufacturer to be free from defects in equipment, materials and workmanship for a period of 5 years from the date of final acceptance by the Owner, during which time all above mentioned defects shall be corrected and all services incidental to proper performance shall be provided free of charge.

PART 2 – PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Columbia, Day-Brite, Hubbel, Lightolier, Lithonia, Metalux, H.E. Williams or approved equal.

2.02 DESCRIPTION

A. General:

1. Refer to Fixture Schedule shown on drawings.

B. Recessed or surface mounted, static troffers:

1. Housing:

a. Rigid, die formed, 22 gauge steel.

2. Door/frame:

a. Mitered corners, guide post spring loaded latches, safety chain.

3. Finish:

a. Phosphatized, high reflectance baked white enamel (unless otherwise noted); paint after fabrication.

4. Lens:

a. 0.125 inches (minimum), virgin acrylic, prismatic (unless otherwise noted).

C. Accessories:

1. Connectors, finish rings, trim pieces, end caps, light traps and/or gaskets, sockets.

PART 3 – EXECUTION

3.01 INSTALLATION

A. Arrange units as shown on the drawings, complete with necessary adjustments to assure a coordinated installation relative to work (ceiling systems, diffusers and grilles, fire alarm system devices, sprinkler heads, fire suppression system discharge nozzles, etc.) performed by other trades.

B. Units shall be complete with design features and all necessary accessories required to properly accommodate the associated ceiling system (exposed grid, concealed spline, plaster, metal pan, etc.).

C. Support units level and plumb from the building structural system (directly or indirectly, complete with necessary secondary framing) with two supports, minimum (multiple attachments as required), in conformance with the following:

1. Suspended ceiling systems (units weighing 5 pounds or more):

a. #9, galvanized steel ceiling wire.

2. Structural ceiling systems (units weighing 5 pounds or more):

a. Bridge ceiling system structure.

3. Exposed units (without ceiling systems):

   a. 1/8 inch, steel aircraft cable or pendant canopy sets.

   b. #14, zink plated, steel jack chain. (mechanical rooms/utility areas only)

   c. 1/4 inch, threaded, galvanized, steel rod. (mechanical rooms/utility areas only)

D. Thoroughly clean fixture exposed surfaces, lenses and lamps.

E. Wire unwired and rewire units as required to accommodate lighting systems parameters.

3.02 TESTING AND BALANCING

A. Promptly complete all work necessary to complement system testing to ensure calibration, adjustment, programming and operation herein specified/noted on contract documents.

3.03 SYSTEMS CHECK-OUT (COMMISSIONING)

A. Subsequent to completing the interior lighting systems, the Electrical Contractor, in conjunction with the Engineer, shall orchestrate a demonstrative "check-out" of the systems operation.

B. In addition to the Engineer's representative(s), the following parties shall participate:

   1. The Electrical Contractor's Project Manager and Foreman.

C. The above system, under the conjunctive direction of the Electrical Contractor's project manager and the Engineer's representative shall demonstrate system operation.

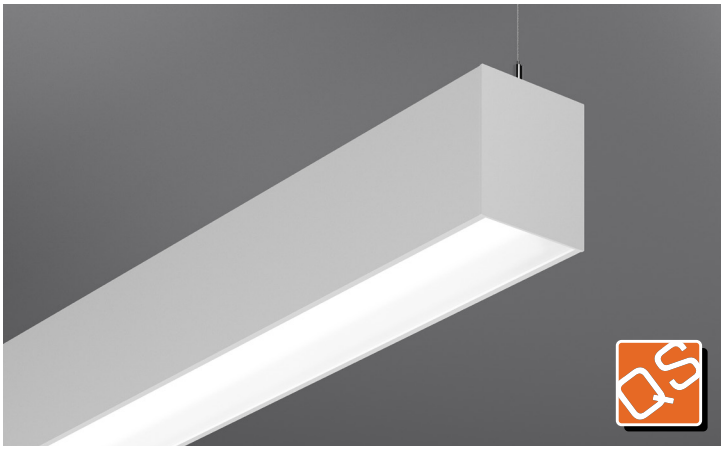
END OF SECTION

NULITE

DATE: PROJECT:

CATALOG #: TYPE: QTY:

L1A
L1B



Regolo 4

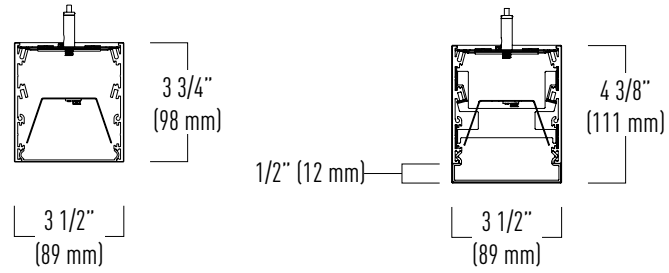
RP44-B

Pendant
BI-DIRECT
Light Distribution

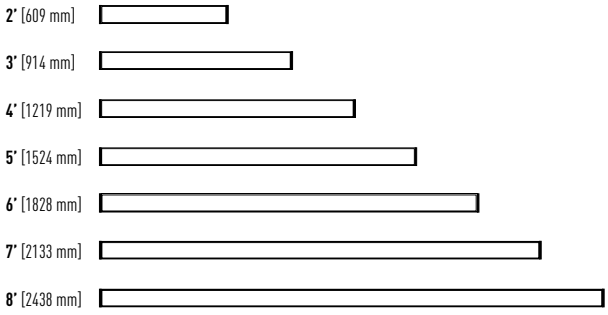
The Regolo RP44-B series is a narrow, nominal 4" wide pendant luminaire system. The slender design is ideal for corridors, open and private offices, classrooms, lobbies and general purpose rooms.

- ***Extruded aluminum housing and heavy gauge end caps***
- ***Configure into linear rows, complex patterns and individual geometric shapes***
- ***Intelligent wireless technology inside from premier connected lighting partners***
- ***Available in 3 standard paint finishes***

Quick Ship: 10 Day lead time for options highlighted in orange. Available in 4' nominal increments; includes 4' & 8' standalone fixtures and continuous rows. Limited to 1000 ft per order.



Standard Individual Fixture Lengths



ORDERING INFORMATION / Example: RP44-B-FRF-BW-09-09-L35-UNV-D-11-WH-T1W048

SERIES	DISTRIBUTION	DIRECT SHIELDING	INDIRECT SHIELDING	LUMENS DOWN	LUMENS UP	CRI & CCT
RP44 - Pendant Mounted Linear LED Luminaire, Nominal 4" Aperture Width	**B** - Bi-Direct	**ST**- Satin White **FR** - Frosted (High Efficiency) **F** - Flush Lens **D** - Drop Lens (Opaque Ends) **L** - Drop Lens (Luminous Ends) **BW** - Batwing Lens **ASYM** - Asymmetric Lens	**0** - Open **BW** - Batwing Optic **ASYM** - Asymmetric Optic **TG** - Top Glow	**03** - 300 lm/ft **05** - 500 lm/ft **06** - 600 lm/ft **09** - 900 lm/ft **10** - 1000 lm/ft **13** - 1300 lm/ft **15** - 1500 lm/ft	**03** - 300 lm/ft **05** - 500 lm/ft **06** - 600 lm/ft **09** - 900 lm/ft **10** - 1000 lm/ft **13** - 1300 lm/ft **15** - 1500 lm/ft	**L** - 80 CRI **H** - 90 CRI **30** - 3000K **35** - 3500K **40** - 4000K

QS-RP44 - Quick Ship 10-Day Lead Time

VOLTAGE	DRIVER	CIRCUITING			FINISH
		Qty of Power Circuits	Qty of Control Circuits	Options	
UNV - Universal 120 - 277V **120V** - 120V **277V** - 277V	**Dimming 0-10V** **D** - Dim to 1% (Standard) **D0** - Dim to 1%, Fade to Off **D02** - Eldoled Solodrive, Dim to 0% **LUTRON** - See options on page 4	**1** - 1 Power **2** - 2 Power	**1** - 1 Control **2** - 2 Control	**B10** - 10 Watt Battery Pack (CEC Compliant) **B15** - 15 Watt Battery Pack (CEC Compliant) **GTD** - Generator Transfer Device (120V or 277V) **EM** - Dedicated Emergency Circuit	**WH** - White Painted Finish **SV** - Silver Painted Finish **BK** - Black Painted Finish **CC** - Custom Color

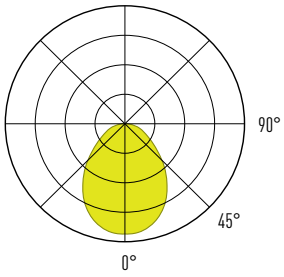
MOUNTING			OPTIONS	LINEAR ROWS
Ceiling Type	**Mounting Hardware Finish**	**Suspension Length**		
T1 - Aircraft Cable to 1" Grid **T9** - Aircraft Cable to 9/16" Grid **TS** - Aircraft Cable to Slotted Grid **SR** - Aircraft Cable to Structure	**W** - White Canopies and Cord **B** - Black Canopies and Cord	**048** - 48" Adjustable Aircraft Cable **120** - 120" Adjustable Aircraft Cable **240** - 240" Adjustable Aircraft Cable	**LEV** - Leviton Integral Sensor **WS** - Wattstopper (Legrand) Integral Sensor **WLX** - Wavelinx (Cooper Lighting Solutions) Integral Sensor **NX** - NX (Hubbel) Integral Sensor **NLT** - nLight (Acuity Brands) Integral Sensor **ATH** - Athena (Lutron) Integral Sensor **LV** - Vive (Lutron) Integral Sensor **ENL** - Enlighted Integral Sensor **CP** - Chicago Plenum **GLR** - Fusing	**2** - 24" **3** - 36" **4** - 48" **5** - 60" **6** - 72" **7** - 84" **8** - 96" **XX** - Specify run lengths in 1/8" increments (QS 4' increments). Consult factory for custom lengths.

L1A
L1B

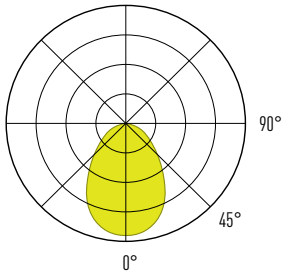
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PHOTOMETRICS

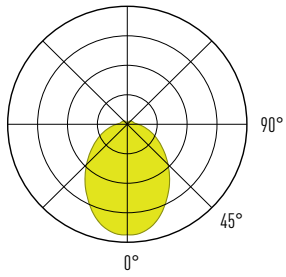
*LUMEN OUTPUT MAY VARY. 3500K / 80 CRI USED FOR RESULTS.



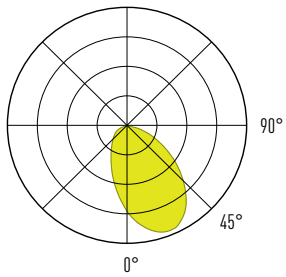
FRF - Frosted Flush Lens			
PACKAGE	**Lumens per ft**	**Watts per ft**	**Lumens per watt**
03	295	2.2	132
05	509	3.8	134
06	603	4.5	134
09	904	7.1	127
10	996	7.9	125
13	1312	10.6	123
15	1508	12.3	122



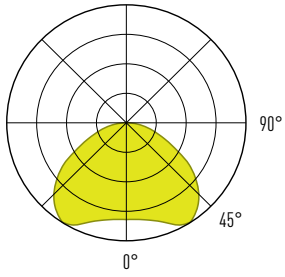
FRR - Frosted Regressed Lens			
PACKAGE	**Lumens per ft**	**Watts per ft**	**Lumens per watt**
03	288	2.2	129
05	497	3.8	131
06	589	4.5	131
09	906	7.3	124
10	996	8.2	122
13	1304	10.8	120
15	1499	12.5	119



FRL - Frosted Drop Lens (Luminous Ends)			
PACKAGE	**Lumens per ft**	**Watts per ft**	**Lumens per watt**
03	299	2.2	133
05	491	3.7	134
06	611	4.5	135
09	893	6.9	130
10	1009	7.9	127
13	1306	10.5	125
15	1508	12.2	124



ASYM - Asymmetric Lens			
PACKAGE	**Lumens per ft**	**Watts per ft**	**Lumens per watt**
03	307	2.2	137
05	505	3.7	138
06	603	4.3	139
09	894	6.7	134
10	989	7.7	129
13	1296	10.1	128
15	1504	11.8	128

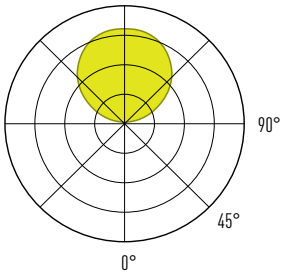


BW - Batwing Lens			
PACKAGE	**Lumens per ft**	**Watts per ft**	**Lumens per watt**
03	305	2.4	126
05	510	4.0	128
06	599	4.7	127
09	910	7.7	118
10	997	8.4	119
13	1298	11.0	118
15	1510	12.9	117

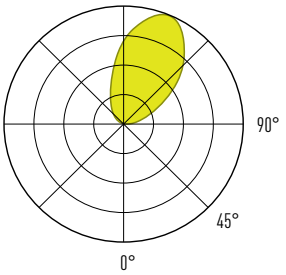
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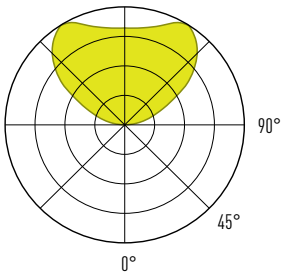
*LUMEN OUTPUT MAY VARY. 3500K / 80 CRI USED FOR RESULTS.



O - Open			
PACKAGE	**Lumens per ft**	**Watts per ft**	**Lumens per watt**
03	297	1.9	159
05	498	3.1	160
06	611	3.8	161
09	892	5.7	157
10	1004	6.4	157



ASYM - Asymmetric Optic			
PACKAGE	**Lumens per ft**	**Watts per ft**	**Lumens per watt**
03	295	2.1	143
05	501	3.4	145
06	604	4.2	145
09	907	6.4	142
10	1007	7.3	138



BW - Batwing Optic			
PACKAGE	**Lumens per ft**	**Watts per ft**	**Lumens per watt**
03	302	2.1	146
05	488	3.3	149
06	593	4.0	149
09	904	6.3	144
10	1007	7.1	142

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DRIVER INFORMATION

NULITE CAT#	DRIVER MANUFACTURER / SERIES	DIMMING / CONTROL PROTOCOL	DIM RANGE	NOTES/ DESCRIPTION
D	Signify Xitanium, Osram OTI	0-10v	100% -1%	Standard Nulite driver, base fixture price
D0	Signify Xitanium, Osram OTI	0-10v	100%- 1% (Steps from 1% to 0% or OFF)	Standard Nulite driver, base fixture price
D02	Eldoled Solodrive	0-10v	100% - 0%	Logarithmic Dimmng Curve
L11	Lutron Hi-Lume Premier (PEQOE) Max lumen package 03	0-10v	100% - 0.1%	Hi-lume Premier 0.1% EcoSyetem LED driver with Soft-on, Fade-to-Black dimming technology
L15	Lutron Hi-Lume Series (LDE1)	0-10v	100% - 1%	Hi-Lume 1% EcoSystem LED driver with Soft-on, Fade-to-Black dimming technology
ELE	Eldoled Ecodrive	DALI	100% - 1%	Logarithmic Dimming Curve
ELS	Eldoled Solodrive	DALI	100% -0%	Logarithmic Dimming Curve

Lens Options



Frosted Lens
This diffuser is designed for a balance between efficiency and lens uniformity. (Transmission ~ 89%)

Satin White Lens
This diffuser is designed for visible lens uniformity. It's recommended for regressed lens configuration in our shallow housing. (Transmission ~ 69%)

DSOS Sensor Option:



Integral Daylight and Occupancy Sensor
The Regolo series is available with a combination PIR occupancy and daylight sensor for daylight harvesting. Consult factory for more details on sensor operation and commissioning.

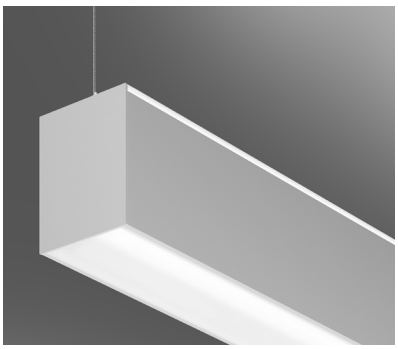
"L" Luminous Acrylic End Drop Lens



Opaque Metal End Drop Lens "D"



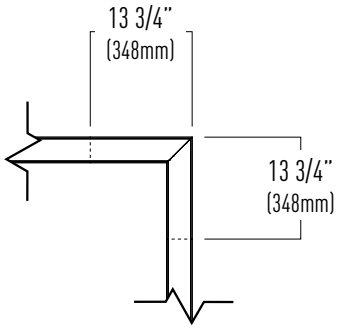
TOP-GLOW OPTION

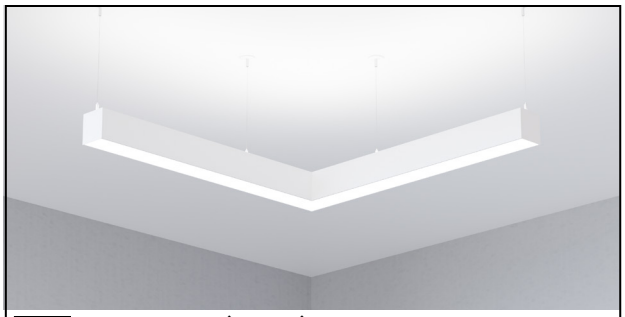


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STANDARD INDIVIDUAL SHAPES - LINEAR MOUNTING DETAIL

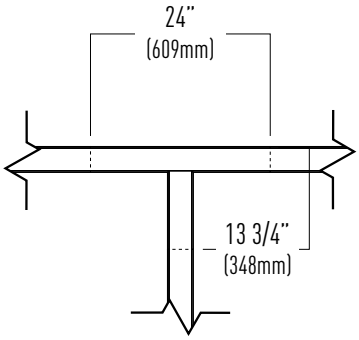
L-Intersection

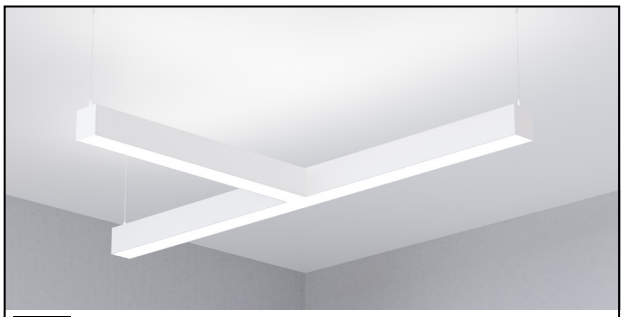




L **L-Intersection (Corner)**
Available Standard configurations: 90°

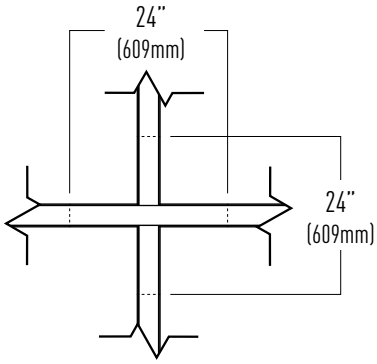
T-Intersection

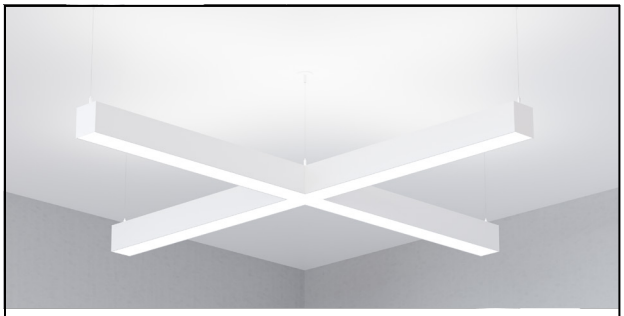




T **T-Intersection**
Available Standard configurations: 90°+90°

X-Intersection





X **X-Intersection**
Available Standard configurations: (2)90°+90°

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PRODUCT SPECIFICATIONS AND INFORMATION

HOUSING CONSTRUCTION

The housing is a hybrid of extruded aluminum side rails and formed 20 gauge cold rolled steel. Housing standard finish is electrostatically applied textured white powder coat paint.

LEDS AND OPTICAL SYSTEM

Optical systems consist of a single row of mid power constant current LEDs mounted to a removable highly reflective powder coated metal reflector. Frosted lens diffuses LED light source while delivering high efficacy general illumination.

STANDARD DIMMING LED DRIVERS

Standard constant current integral electronic 0-10v dimming input. Two standard driver options are available. Option **D** dims to 1% and option **D0** dims to 0% or OFF (the final 1 percent is a "step"). Both options are the same price and representative of the base fixture price. Options **D** and **D0** ship with 5 wires (Line Voltage- Black and White wires, Low Voltage- Purple and Pink wires, Ground- Green wire).

DALI DRIVERS

Standard constant current DALI drivers available in either a dim to 1% **(ELE)** or dim to 0% **(ELS).** DALI fixtures ship with 5 wires (Line Voltage- Black and White wires, Low Voltage- Purple and Pink wires, Ground- Green wire).

LIGHT OUTPUT

Standard factory set light outputs are programmed to within +/- 5% of the nominal light level at 3500K 80 CRI LEDs. Light output, wattage, and efficacy will vary across different CRI's CCT's. Refer to ies files on the website for actual detailed lighting performance data.

CIRCUITING

Each luminaire may have up to 2 line voltage (Power) circuits and 2 low voltage (Control) circuits. Two power circuits are required for independent control of uplight and downlight in bi-direct luminaires, and low voltage control circuits are for independent dimming of each circuit.

Examples:

- **"1-1"-** 1 power circuit (Line Voltage) and 1 control circuit (Low Voltage) > 5 wires total (1 Black Wire "Hot", 1 White Wire "Neutral", 1 Green Wire "Ground", and 2 low voltage control wires, 1 Pink wire and 1 Purple wire)
- **"2-2"-** 2 power circuits (Line Voltage) and 1 control circuit (Low Voltage) > 9 wires total (2 Black Wires "Hot", 2 White Wires "Neutral", 1 Green Wire "Ground", and 4 low voltage control wires, 2 Pink wires and 2 Purple wires)

BATTERY PACKS

Recyclable Ni-Cad battery pack, battery run time is 90 minutes. Recharge time of 24 hours. Battery packs up to 15W are available. To calculate Battery Lumen Output, multiply luminaire efficacy by battery wattage. (example: 120 lms/watt **(120) x B10** Battery Wattage **(10)** = **1200** lumens of egress illumination for 90 minutes.) Battery option not available in fixtures less than 4', and other limitations apply, consult factory. Entire "direct" fixture housing is energized by battery for lengths up to 5'. Half of direct fixture is energized by battery for 6' - 8' housing lengths. Emergency or night light circuit available (requires additional power circuit). Battery fixtures ship with an additional Orange "constant hot" wire.

LUMEN MAINTENANCE

90% of initial light output (L90) at 100,000+ hours, 70% of initial light output (L70) at 200,000+ hours calculated.

GENERATOR TRANSFER DEVICES

The GTD emergency lighting control device senses the loss of normal power and switches the AC driver input power connection to an unswitched, generator (or central inverter) supplied lighting circuit. GTD fixtures ship with 3 additional wires (Orange wire "constant hot", Black-Red wire "generator hot", White-Red wire "generator neutral").

FIXTURE FINISHES

Standard finishes are powder coat painted white **(WH)**, black **(BK)** or silver **(SV)**. Consult factory for custom color **(CC)** finishes.

INSTALLATION AND MOUNTING

Pendant luminaires mount to Acoustical Grid Ceilings **(T1,T9,TS)**, and Various Structural Ceilings **(SR)**. The product is suspended with adjustable aircraft cable up to 240" from ceiling surface. Luminaires may be individually mounted or continuously mounted in linear configurations or complex geometric patterns. Refer to data sheets and installation instructions for details on fixture dimensions, mounting location dimensions and available luminaire configurations.

WARRANTY

5-year limited warranty on LED and driver from date of shipment. Refer to the full warranty details on nulite.lighting

WEIGHT

Fixtures are 3.25 lbs/ft, Driver box weights vary per enclosure type and electrical configuration, consult factory.

APPROVALS

ETL listed, conforms to UL Standard 1598 and CSA Standard C22.2, indoor dry/damp locations.

TESTING AND CERTIFICATION

All of Nulite's LED components have been tested under **LM-80** guidelines ensuring 6000 hours of luminous flux data. Additionally Nulite can supply **LM-79** data on all luminaires. This data includes luminous flux, electrical power, efficiency, chromaticity as well as the diffusion of luminous intensity.

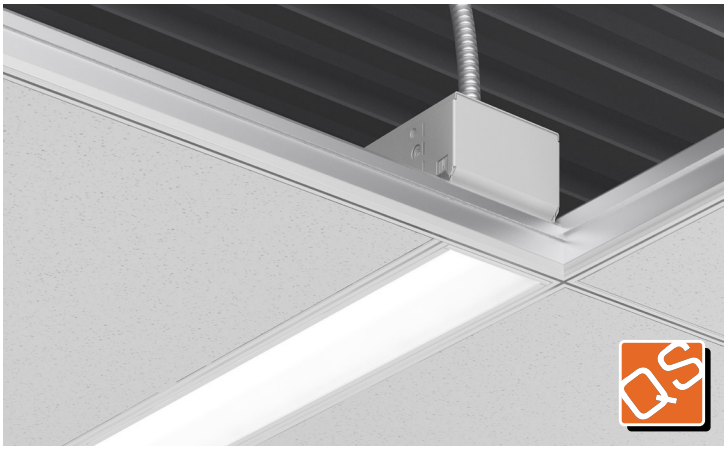
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NULITE

DATE: PROJECT:

CATALOG #: TYPE: QTY:

L2A
L2B
L2C
L2D
L2E



Regolo 4
RG4

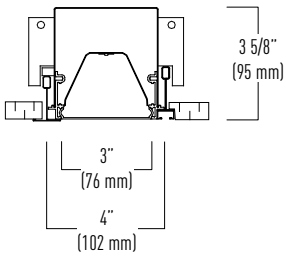
Recessed/Grid

DIRECT
Light Distribution

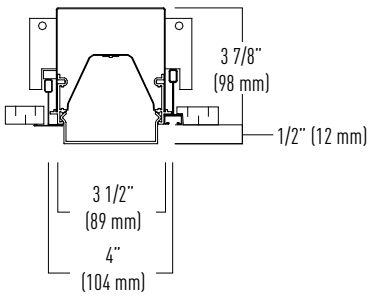
The Regolo RG4 series is a narrow recessed, nominal 4" wide profile, slot unit designed for grid ceiling systems. The slender design is ideal for corridors, open and private offices, classrooms, lobbies and general purpose rooms.

- ***Extruded aluminum side rails and heavy gauge end caps***
- ***Configure into linear rows, complex patterns and individual geometric shapes***
- ***Intelligent wireless technology inside from premier connected lighting partners***
- ***IC Rated***

Quick Ship: 10 Day lead time for options highlighted in orange. Available in 4' nominal increments; includes 4' & 8' standalone fixtures and continuous rows. Limited to 1000 ft per order.

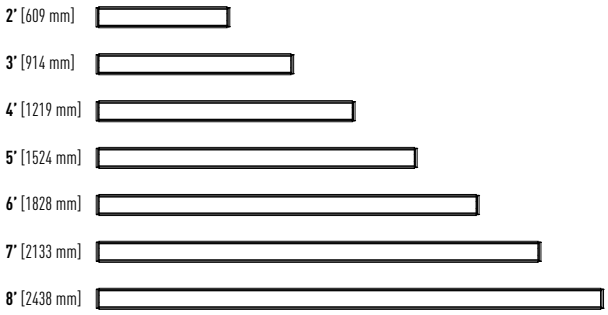


RG4 / Frosted Flush Lens



RG4 / Frosted Drop Lens

Standard Individual Fixture Lengths



ORDERING INFORMATION / Example: RG4-D-FRF-09-L35-UNV-D-11-WH

SERIES

RG4 - Recessed Linear LED Luminaire Designed for Grid Ceilings, Nominal 4" Aperture Width.

RT4 for L2A at Fixed Bench only (see detail 06/A-908)

DISTRIBUTION

D - Direct

DIRECT SHIELDING

ST- Satin White
FR - Frosted (High Efficiency)
F - Flush Lens
R - Regressed Lens
D - Drop Lens (Opaque Ends)
L - Drop Lens (Luminous Ends)
BW - Batwing Lens
ASYM - Asymmetric Lens

LUMENS DOWN

03 - 300 lm/ft
05 - 500 lm/ft
06 - 600 lm/ft
09 - 900 lm/ft
10 - 1000 lm/ft
13 - 1300 lm/ft
15 - 1500 lm/ft

Per schedule

CRI & CCT

L - 80 CRI
H - 90 CRI

30 - 3000K
35 - 3500K
40 - 4000K

VOLTAGE

UNV - Universal 120 - 277V
120V - 120V
277V - 277V

DRIVER

Dimming 0-10V
D - Dim to 1% (Standard)
D0 - Dim to 1%, Fade to Off
D02 - Eldoled Solodrive, Dim to 0%
LUTRON - See options on page 3

CIRCUITING

Qty of Power Circuits
1 - 1 Power
2 - 2 Power

Qty of Control Circuits
1 - 1 Control
2 - 2 Control

Options
B10 - 10 Watt Battery Pack (CEC Compliant)
B15 - 15 Watt Battery Pack (CEC Compliant)
GTD - Generator Transfer Device (120V or 277V)
EM - Dedicated Emergency Circuit

FIXTURE FINISH

WH - White Painted Finish
SV - Silver Painted Finish
BK - Black Painted Finish
CC - Custom Color

OPTIONS

LEV - Leviton Integral Sensor
WS - Wattstopper (Legrand) Integral Sensor
WLX - Wavelinx (Cooper Lighting Solutions) Integral Sensor
NX - NX (Hubbel) Integral Sensor
NLT - nLight (Acuity Brands) Integral Sensor
ATH - Athena (Lutron) Integral Sensor
LV - Vive (Lutron) Integral Sensor
ENL - Enlighted Integral Sensor
CP - Chicago Plenum
GLR - Fusing

FIXTURE LENGTH

2 - 24"
3 - 36"
4 - 48"
5 - 60"
6 - 72"
7 - 84"
8 - 96"

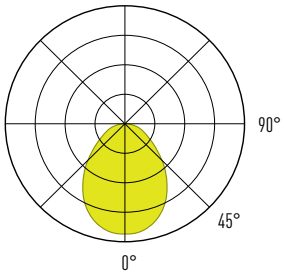
Per schedule

XX - Specify run lengths in 1/8" increments (QS 4' increments). Consult factory for custom lengths.

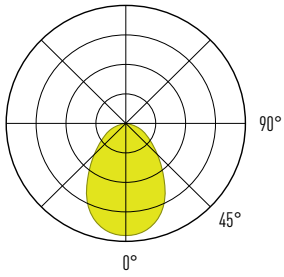
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PHOTOMETRICS

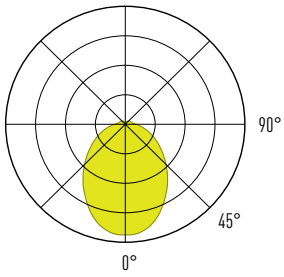
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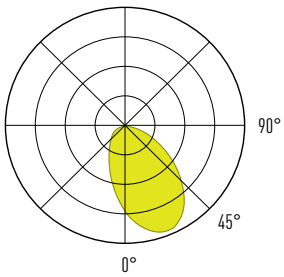
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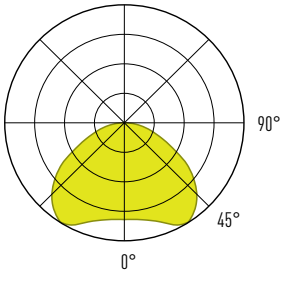
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PACKAGE	**Lumens per ft**	**Watts per ft**	**Lumens per watt**
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09	906	7.3	124
10	996	8.2	122
13	1304	10.8	120
15	1499	12.5	119



FRL - Frosted Drop Lens (Luminous Ends)			
PACKAGE	**Lumens per ft**	**Watts per ft**	**Lumens per watt**
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09	893	6.9	130
10	1009	7.9	127
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15	1508	12.2	124



ASYM - Asymmetric Lens			
PACKAGE	**Lumens per ft**	**Watts per ft**	**Lumens per watt**
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13	1296	10.1	128
15	1504	11.8	128



BW - Batwing Lens			
PACKAGE	**Lumens per ft**	**Watts per ft**	**Lumens per watt**
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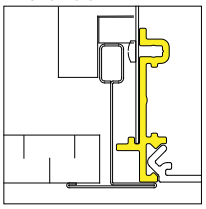
DRIVER INFORMATION

NULITE CAT#	DRIVER MANUFACTURER / SERIES	DIMMING / CONTROL PROTOCOL	DIM RANGE	NOTES/ DESCRIPTION
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D0	Signify Xitanium, Osram OTI	0-10v	100%- 1% (Steps from 1% to 0% or OFF)	Standard Nulite driver, base fixture price
D02	Eldoled Solodrive	0-10v	100% - 0%	Logarithmic Dimmng Curve
L11	Lutron Hi-Lume Premier (PEQ0E) Max lumen package 03	0-10v	100% - 0.1%	Hi-lume Premier 0.1% EcoSyetem LED driver with Soft-on, Fade-to-Black dimming technology
L15	Lutron Hi-Lume Series (LDE1)	0-10v	100% - 1%	Hi-Lume 1% EcoSystem LED driver with Soft-on, Fade-to-Black dimming technology
ELE	Eldoled Ecodrive	DALI	100% - 1%	Logarithmic Dimming Curve
ELS	Eldoled Solodrive	DALI	100% -0%	Logarithmic Dimming Curve

T-BAR MOUNTING HEIGHT

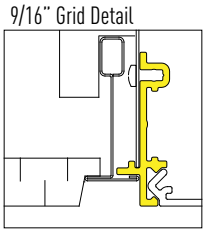
Grid Detail

1" Grid Detail

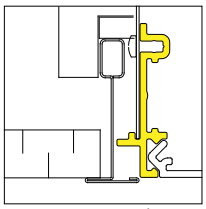


Standard Tile
Fixture is compatible "T" heights up to 1 1/2"

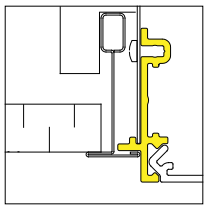
9/16" Grid Detail



Tegular Tile

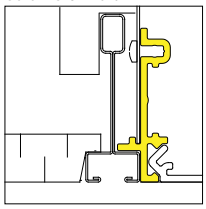


Standard Tile - 1-1/2" "T" height & supported by grid hook extension



Standard Tile - Drop-down Luminaire

Screw Slot Detail



Tegular Tile

Lens Options



Frosted Lens
This diffuser is designed for a balance between efficiency and lens uniformity. (Transmission ~ 89%)

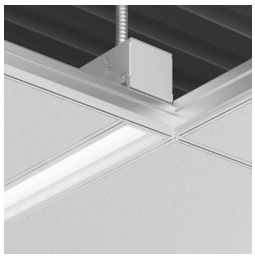
Satin White Lens
This diffuser is designed for visible lens uniformity. It's recommended for regressed lens configuration in our shallow housing. (Transmission ~ 69%)

DSOS Sensor Option:



Integral Daylight and Occupancy Sensor
The Regolo series is available with a combination PIR occupancy and daylight sensor for daylight harvesting. Consult factory for more details on sensor operation and commissioning.

Regressed Lens "R"



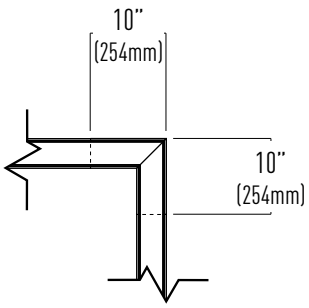
Drop Lens "L"



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STANDARD INDIVIDUAL SHAPES - LINEAR MOUNTING DETAIL

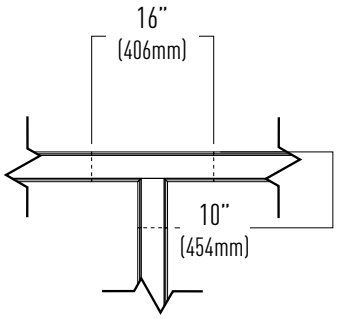
L-Intersection





L **L-Intersection (Corner)**
Available Standard configurations: 90°

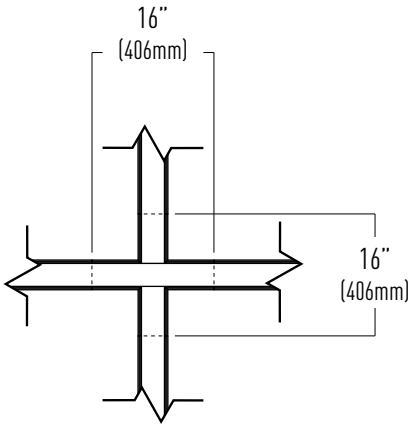
T-Intersection





T **T-Intersection**
Available Standard configurations: 90°+90°

X-Intersection





X **X-Intersection**
Available Standard configurations: (2)90°+90°

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PRODUCT SPECIFICATIONS AND INFORMATION

HOUSING CONSTRUCTION

The housing consists of visible white powder coat extruded aluminum trim rails, with formed 20 gauge galvanized steel back channel and heavy gauge end caps. Steel alignment tabs and white snap-in joiner clips are used for continuous row applications. Luminaire is finished textured white.

LEDS AND OPTICAL SYSTEM

Optical systems consist of a single row of mid power constant current LEDs mounted to a removable highly reflective powder coated metal reflector. Frosted lens diffuses LED light source while delivering high efficacy general illumination.

STANDARD DIMMING LED DRIVERS

Standard constant current integral electronic 0-10v dimming input. Two standard driver options are available. Option **D** dims to 1% and option **D0** dims to 0% or OFF (the final 1 percent is a "step"). Both options are the same price and representative of the base fixture price. Options **D** and **D0** ship with 5 wires (Line Voltage- Black and White wires, Low Voltage- Purple and Pink wires, Ground- Green wire).

DALI DRIVERS

Standard constant current DALI drivers available in either a dim to 1% **(ELE)** or dim to 0% **(ELS).** DALI fixtures ship with 5 wires (Line Voltage- Black and White wires, Low Voltage- Purple and Pink wires, Ground- Green wire).

LIGHT OUTPUT

Standard factory set light outputs are programmed to within +/- 5% of the nominal light level at 3500K 80 CRI LEDs. Light output, wattage, and efficacy will vary across different CRI's CCT's. Refer to ies files on the website for actual detailed lighting performance data.

CIRCUITING

Each luminaire may have up to 2 line voltage (Power) circuits and 2 low voltage (Control) circuits. Two power circuits are required for independent control of uplight and downlight in bi-direct luminaires, and low voltage control circuits are for independent dimming of each circuit.

Examples:

- **"1-1"-** 1 power circuit (Line Voltage) and 1 control circuit (Low Voltage) > 5 wires total (1 Black Wire "Hot", 1 White Wire "Neutral", 1 Green Wire "Ground", and 2 low voltage control wires, 1 Pink wire and 1 Purple wire)
- **"2-2"-** 2 power circuits (Line Voltage) and 1 control circuit (Low Voltage) > 9 wires total (2 Black Wires "Hot", 2 White Wires "Neutral", 1 Green Wire "Ground", and 4 low voltage control wires, 2 Pink wires and 2 Purple wires)

BATTERY PACKS

Recyclable Ni-Cad battery pack, battery run time is 90 minutes. Recharge time of 24 hours. Battery packs up to 15W are available. To calculate Battery Lumen Output, multiply luminaire efficacy by battery wattage. (example: 120 lms/watt **(120) x B10** Battery Wattage **(10)** = **1200** lumens of egress illumination for 90 minutes.) Battery option not available in fixtures less than 4', and other limitations apply, consult factory. Entire "direct" fixture housing is energized by battery for lengths up to 5'. Half of direct fixture is energized by battery for 6' - 8' housing lengths. Emergency or night light circuit available (requires additional power circuit). Battery fixtures ship with an additional Orange "constant hot" wire.

LUMEN MAINTENANCE

90% of initial light output (L90) at 100,000+ hours, 70% of initial light output (L70) at 200,000+ hours.

GENERATOR TRANSFER DEVICES

The GTD emergency lighting control device senses the loss of normal power and switches the AC driver input power connection to an unswitched, generator (or central inverter) supplied lighting circuit. GTD fixtures ship with 3 additional wires (Orange wire "constant hot", Black-Red wire "generator hot", White-Red wire "generator neutral").

FIXTURE FINISHES

Standard finishes are powder coat painted white **(WH)**, black **(BK)** or silver **(SV)**. Consult factory for custom color **(CC)** finishes.

INSTALLATION AND MOUNTING

The "Grid" recessed option is designed to use tie-in T-bar brackets to secure the luminaire to the ceiling grid from above (**T1, T9 or TS**). IC rated. Individual mount or continuous runs. Regolo 4 series may be configured into geometric patterns. Mitered housings may be configured into corners, X-intersections, and T-Intersections. Standard mitered angles of 90° can be utilized to create an unlimited array of designs and layouts. The submittal drawing (shop drawing) furnished by Nulite will adequately detail these configurations and sign-off is required to initiate production.

WARRANTY

5-year limited warranty on LED and driver from date of shipment. Refer to the full warranty details on https://nulite.lighting/.

WEIGHT

Fixtures are 3.25 lbs/ft, Driver box weights vary per enclosure type and electrical configuration, consult factory.

APPROVALS

ETL listed, conforms to UL Standard 1598 and CSA Standard C22.2, indoor dry/damp locations.

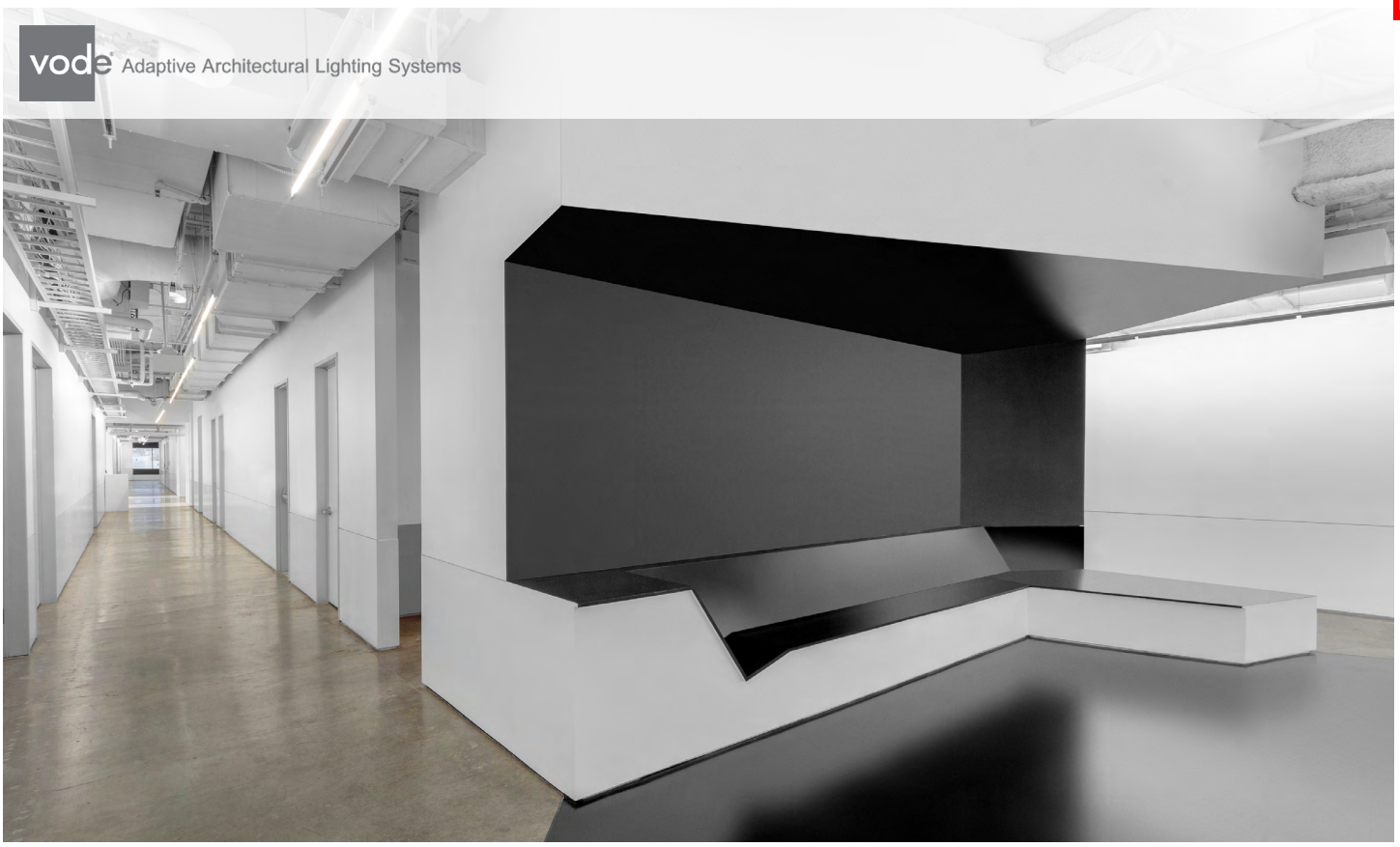
TESTING AND CERTIFICATION

All of Nulite's LED components have been tested under **LM-80** guidelines ensuring 6000 hours of luminous flux data. Additionally Nulite can supply **LM-79** data on all luminaires. This data includes luminous flux, electrical power, efficiency, chromaticity as well as the diffusion of luminous intensity.

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L3A
L3B
L3C

vode Adaptive Architectural Lighting Systems



Spec Guide

WingRail | Ceiling Cable | 107

Red List Approved
Declare.

Direct or indirect lighting for wall wash, grazing and ceiling wash applications.



WingRail: direct or indirect, infinite rotation.

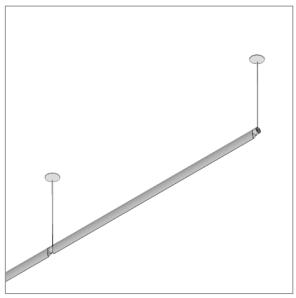
Benefits & Features

Minimal Profile, Robust Design
Asymmetric profile, 1.14" (29mm) x 2.12" (54mm).

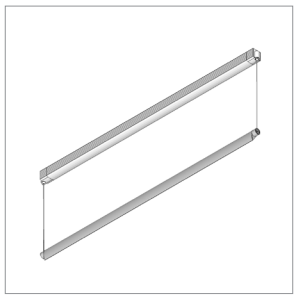
Superior Light Quality & Performance
Output up to 1376 lm/ft (4516 lm/m) (HO), 121 lm/W (SO). 80 or 90 CRI & tunable white (2200K-5000K) available.

Adaptive Power
Full range dimming power for all protocols. Integral or remote power available.

Better Optics & Beam Control Options
Asymmetric distribution. White or black baffle, EdgeSoft™ lens or diffuse lens and narrow optics available. Directional control with infinite rotation, angle gauge and lock.



Small Round Canopy, Remote Power



Integral Power

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Build Your Specification

107-WG	01			CC	

System & Rail Type
107-WG WingRail

Single/Double Rail
01 Single Rail

System Length
Specify overall system length in ft/in or M/mm.

Corner and Shapes Available ***See Guide*** *for details.*

Rail Length
24 24" (610mm)
36 36" (914mm)
48 48" (1219mm)
60 60" (1524mm)
72 72" (1829mm)
ZZ Other rail length or layout (please specify)

Per schedule

See ***Rail Length Chart*** *for more details.*

Mounting
CC Ceiling Cable

Cable Length
Field adjustable.
48 48" cable (1219mm)
96 96" cable (2438mm)
ZZ Other (please specify)

Power Location

Integral Power
IP Integral Power

Remote Power
Specify mounting and harness length code example: **2R25, 4R25**...etc.

Mounting Option
2R Small Round Canopy
4R Large Round Canopy

Wire Harness
10 10' (3.048m) Wire Harness
25 25' (7.62m) Wire Harness
50 50' (15.24m) Wire Harness
75 75' (22.86m) Wire Harness
100 100' (30.48m) Wire Harness

Power Type

Flexible 1 to 1 Power
AE 0-10v, 1.0% Dimming
AT 0-10v, 0.1% Dimming
AD DALI, 0.1% Dimming
AX DMX, 100-0% Dimming
AH Hi-lume 1% EcoSystem, Soft On / Fade to Black Technology, LDE[1]
AH2 ELV 1% 2-wire (Forward and Reverse Phase)

Optimized Power
Add '**O**' to power type example: AE**O**, AT**O**...etc. [1]

VodeNODE
Add '**N**' to power type for Flexible 1 to 1 Power
Add '**ON**' to power type for Optimized Power
example: AE**N**, AT**N**, AE**ON**, AD**ON**...etc. [2]

ZZ Other (please specify)

See ***Power Guide*** *for driver features & limitations.*

Voltage
1 120V
2 120V - 277V
X Not Yet Specified

Emergency Power
0 No Emergency Power
ZZ Emergency Power *(specify requirements)*

LED Type
Z Zipper Board
B Button Board [3]

Lumen Output
LO Low Output
SO Standard Output
HO High Output
ZZ Other (please specify)

See ***IES Files*** *page for details.*
See ***Power Guide*** *for driver features & limitations.*

Color Temperature

80+ CRI
27 2700K
30 3000K
35 3500K
40 4000K

90+ CRI
279 2700K
309 3000K
359 3500K
409 4000K

ZZ Tunable White Available
See Guide for details.

Optics

Zipper Board (Z)
WB White Baffle with EdgeSoft™
BB Black Baffle with EdgeSoft
C1 Clear with EdgeSoft
D1 Diffuse

Button Board (B)
19 19° x 48° Oval
36 36° Medium

Sensors [7]
0 None
ENC Canopy with integrated Enlighted Micro Sensor [6]
WSC Canopy with integrated Legrand Wattstopper sensor [6]
LAC Canopy with integrated Lutron Athena sensor [6]
ZZ Other (please specify)

Finish
AL Clear Anodized
WH White Powder Coat
BL Black Anodized
ZZ Custom finishes available. Please specify RAL #

Options
0 None
9 9' 18/3 Cord and Plug
CP Chicago Plenum
LLLC Luminaire Level Lighting Controls

NOTES & LIMITATIONS

[1] *Optimized Power is not available with Hi-lume 1% EcoSystem (AHO) Power Type.*
[2] *VodeNODE enclosure is not available with ELV 1% 2-wire (AH2) Power Type.*
[3] *Button Board (B) is not available in 90 CRI.*
[4] *9' 18/3 Cord and Plug only available with Remote Power (RP).*
[5] *Chicago Plenum not applicable for wall arm mounting.*
[6] *Rotating fixture as an uplight will interfere with sensor operation.*
[7] *Sensors, drivers and control units that are integrated into Vode fixtures are discrete components that communicate with network lighting controls. For more information about each network lighting control system, visit the manufacturer's website for additional system information and technical data sheets.*
For general information about network lighting controls, consult the DesignLights Consortium® (DLC) ***Networked Lighting Control Qualified Product List****.*

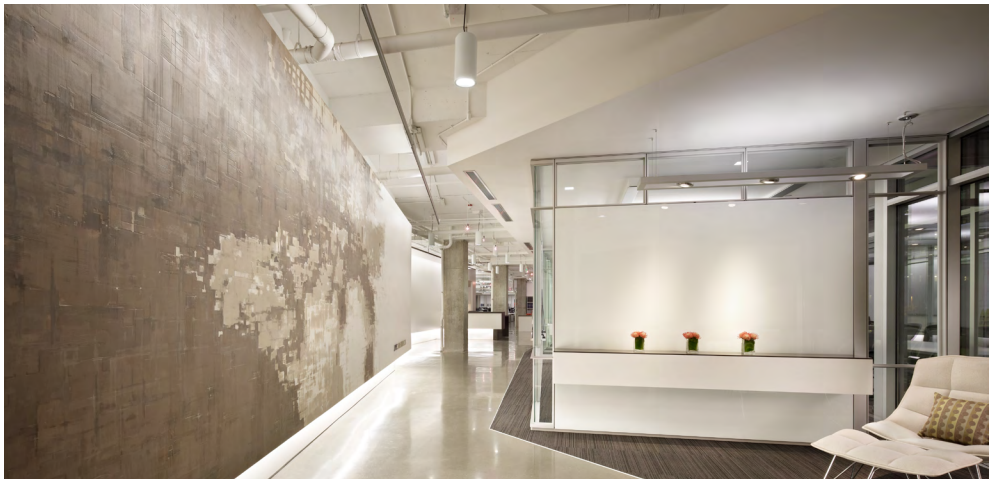
Standard 5 Year Limited Warranty. See details ***here****. Contact factory for options on Limited Warranties up to 20 years.*

Listed to UL standards for damp location by a Nationally Recognized Testing Laboratory (NRTL) recognized by OSHA. Certain limitations exist for each Certification. Contact factory for verification.

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Applications

Interior Corporate, Educational and Retail



JCP Architects, Bellevue, WA



ArtCenter College of Design, Arroyo Parkway, Pasadena, CA

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Declare Label

All Vode Lighting linear light fixtures proudly carry the Red List Approved designation.

See ***International Living Future Institute*** website for details.

Declare.

Vode Adaptive Architectural Lighting Systems
Vode Lighting LLC

Final Assembly: Sonoma, California, US
Life Expectancy: 10+ Year(s)
End of Life Options: Recyclable (100%)

Ingredients:

Anodized Aluminum (6063-T5 Alloy); Steel; Small Electrical Component (RoHS)[1]; Copper; Fluorinated Ethylene Propylene (masterbatch)[2]; Polymethyl methacrylate (PMMA); Stainless Steel; Polyoxymethylene Copolymer (POM); Styrene-butadiene polymer, hydrogenated; Poly(methyl methacrylate/butyl acrylate/styrene) (PMMA/BA/S); Styrene/butadiene copolymer; Distillates; Polypropylene; Calcium carbonate; Polycarbonate; EVA Copolymer; Methyl methacrylate (MMA); Polyphenylene Oxide; Brass; Tin, Organic

[1]LBC Temp Exception RL-002 - Small Electrical Components
[2]LBC Temp Exception RL-023 - Wire Sheathing Subject to NFPA 90A, NFPA 262, UL® 910

Living Building Challenge Criteria: Compliant

I-13 Red List:

☐ LBC Red List Free
■ LBC Red List Approved
☐ Declared

% Disclosed: 100% at 100ppm
VOC Content: Not Applicable

I-10 Interior Performance: Not Applicable
I-14 Responsible Sourcing: Not Applicable

VDE-0001
EXP. 01 JAN 2025
Original Issue Date: 2018

MANUFACTURER RESPONSIBLE FOR LABEL ACCURACY
INTERNATIONAL LIVING FUTURE INSTITUTE™ living-future.org/declare

Red List Approved
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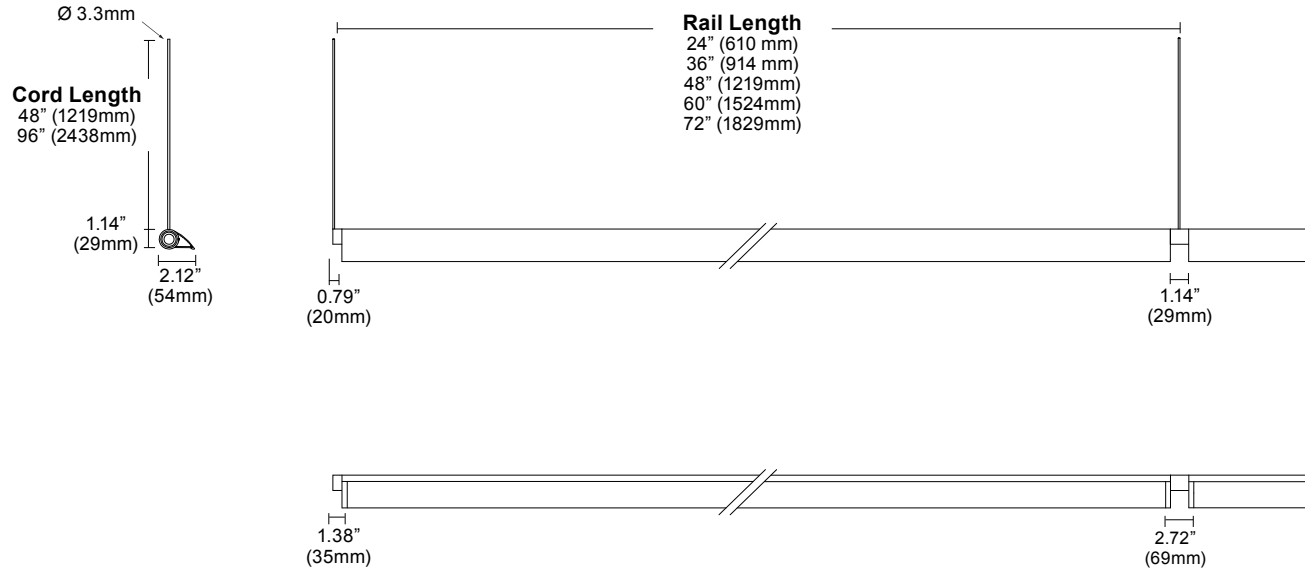
Structure

Rail Lengths	24” (610mm) - 72” (1829mm). Modified lengths available. *See **Rail Length Chart** for more details.*
Rail Dimensions	1.14” (29mm) x 2.12” (54mm) x length.
Construction	Extruded and machined 6063 aluminum.
Mounting	Ceiling mount to jbox or integral power driver housing.
Cable Length	48” (1219mm) and 96” (2438mm) available. Field adjustable. Non-standard cable lengths available.
System Run Length	24” (610mm) minimum. Unlimited maximum.
Operating Temperature	32ºF to 104ºF (0ºC to 40ºC).
Humidity	0-85%, non-condensing.
System Weight	0.74lbs per ft (0.34kg per 305mm) Power supply and housing not included.

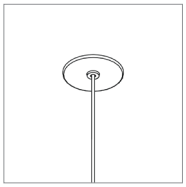
Materials

LED Board Construction	Aluminum core PCB, black LCP connectors, RoHS compliant.
Lens	High-impact extruded acrylic glass (PMMA).
Baffle	6063 aluminum, RoHS compliant painted finish.
Suspension Cable	Ø3.3mm, 22/2 AWG, PVC or TPE and RoHS compliant *(PVC free in 2020).*
Power Cable	Ø4mm, 18/2 AWG, Plenum (CMP) rated semi-rigid PVC or FEP, flame tested UL-910 *(PVC free in 2020).*
Cable Connectors	Unfilled black nylon, rated UL 94 V-0, halogen free, PVC or FEP overmold, RoHS compliant *(PVC free in 2020).*
Remote Linear Power Housing (RLP)	20.7” x 2.375” x 2.53”, 0.054” formed Galvanized Steel.
Remote Brick Power Housing (RBP)	4.32” x 3.37” x .078” Galvanized Steel mounting plate.

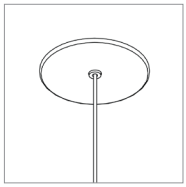
Dimensions



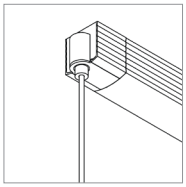
Mounting Options



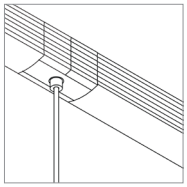
Small Round Canopy
Ø2.5” (51mm)



Large Round Canopy
Ø4.5” (114mm)



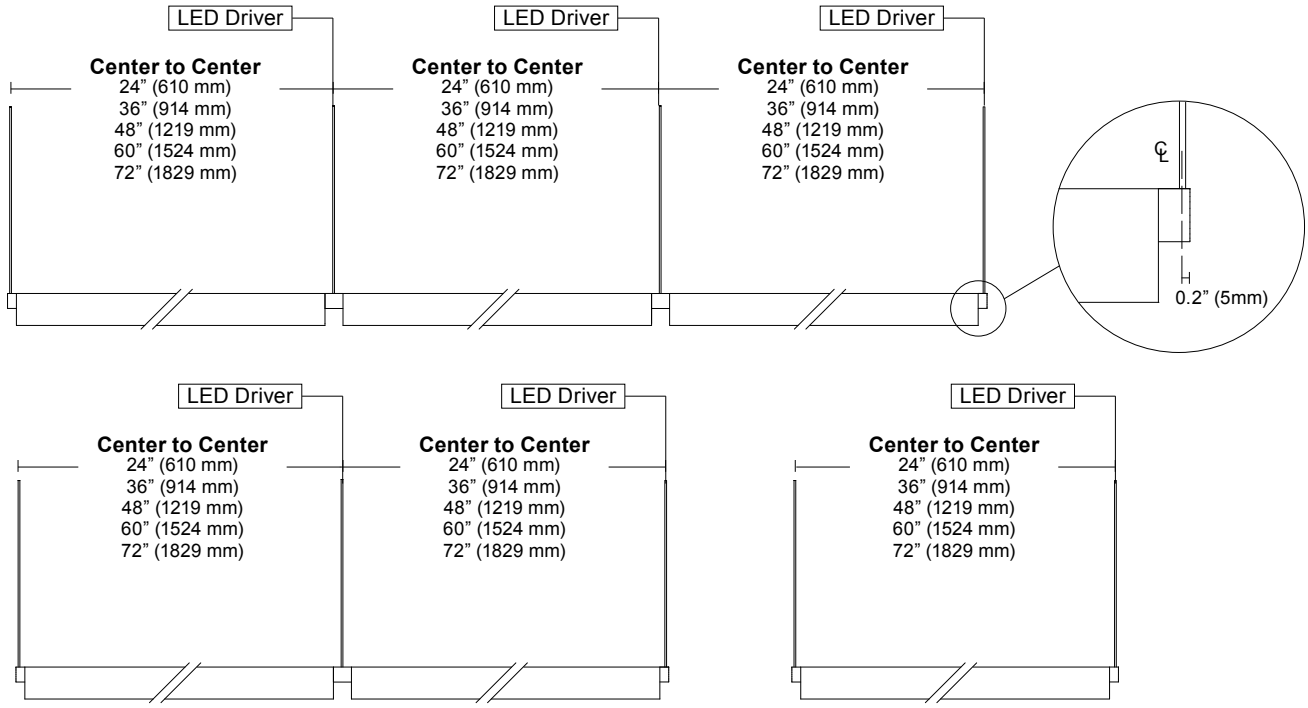
Integral Power (end)
h 1.8” (46mm)
w 1.7” (43mm)



Integral Power (joint)

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Layout



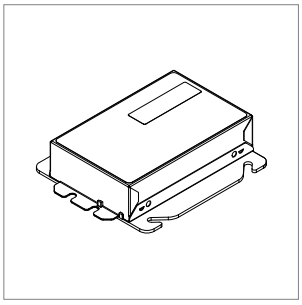
Corner and Shapes Available (Square, Rectangle, L-Shape, U-Shape, ZigZag) ***See Guide*** *for details.*

Power and Controls

Power Type	Class 2 (<60V output) constant current driver.
Dimming Controls	Dimming (0.1%, 1%), 0-10V, DALI, DMX, Hi-lume 1% are available. *See* ***Power Guide*** *for details.*
Input Voltage	120V - 277V, 50/60hz.
Power Location	Integral or remote power. Maximum remote distance up to 100’ (30.5m) *depending* on driver selection. *See* ***Power Guide*** *for details.*

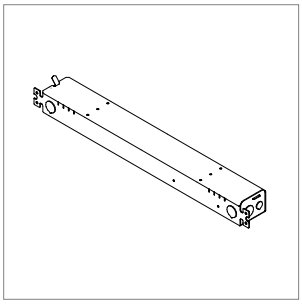
Vode power locations fall into two categories: integral and remote. Remote power is locating the power supply away from the fixture. Remote power comes in two housing styles: brick style and linear style. Consult ***Power Guide*** to determine which type you will receive. Integral power is locating the power supply into the lighting fixture or mounting.

Remote Brick Power Housing



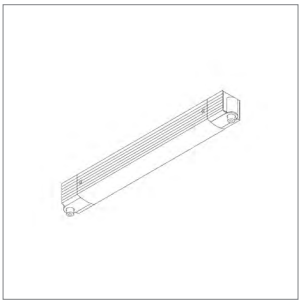
Supplied for some remote power applications. One remote power supply housing is supplied for each rail. Provided driver mounting plate fits standard 4” metal, square J-Boxes with a minimum volume of 21 in^3 (J-Box not provided).
See ***Tech Sheet*** for details.

Remote Linear Power Housing



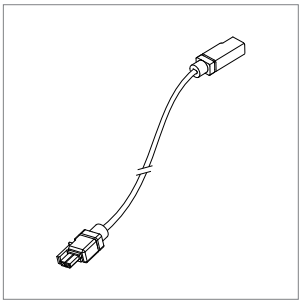
One remote power supply housing is supplied with each power supply. All Vode linear remote drivers come in a 0.054” (0.8mm) formed galvanized steel power supply housing with five (5) knockouts: (4) 1-1/8”, (1) 7/8“ and (1) 9/16”. Accommodates standard linear power supplies.
See ***Tech Sheet*** for details.

Integral Power



Houses integral power supply. Direct conduit feed is recommended, but integral power supply housing will mount to any standard North America 4” j-box. Mounts to most surfaces. Blocking is recommended at all arm junctions.
See ***Tech Sheet*** for details.

Wire Harness

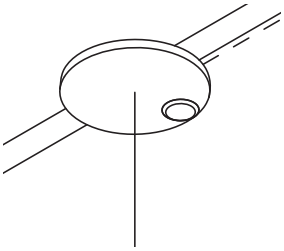


Wire harness connects driver to rail section. Lengths of 10’ (3.0m) & 25’ (7.6m) with snap-lock connectors for quick and easy installation. Multiple harnesses may be combined for lengths up to 100’ (30.5m).
See ***Tech Sheet*** for details.

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vodeCONNECT Sensors

Canopy with integrated sensor

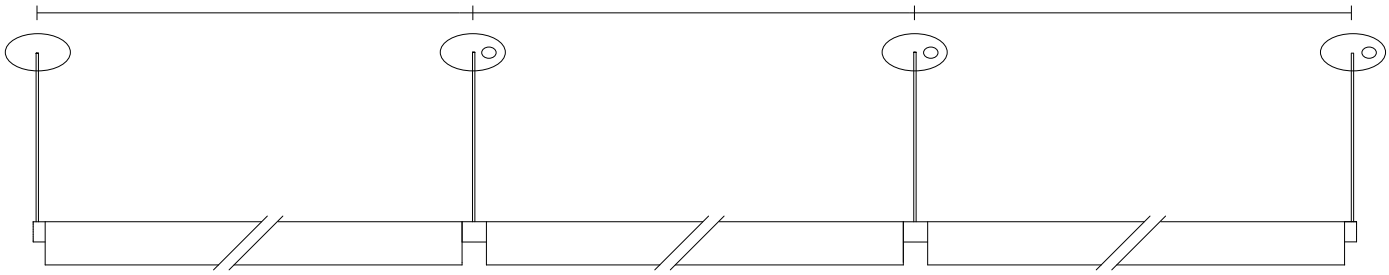


Sensor partners

LUTRON legrand® enlighted

Integrated canopy sensor layout [1]

*1 sensor per fixture. See **vodeCONNECT brochure** for more details.*
NOTES: 1. Available with Large Round Canopy only.



Compatible sensors



Lutron Athena



Legrand Wattstopper



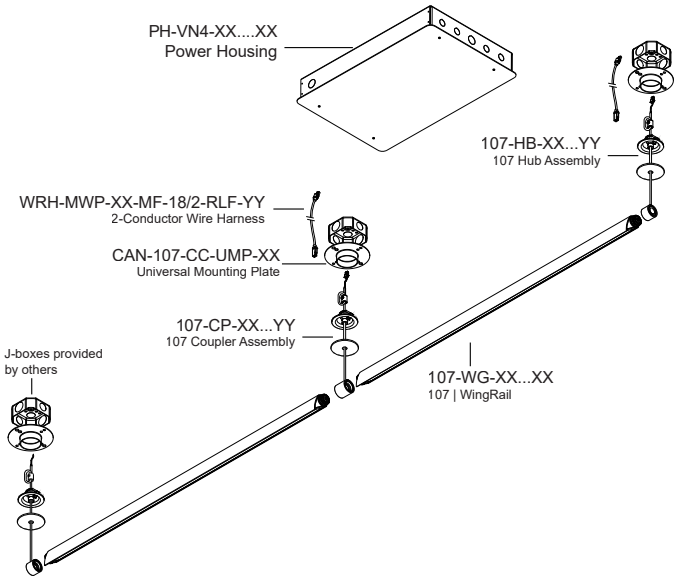
Enlighted Micro Sensor

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Power and Controls

Flexible 1 to 1 power

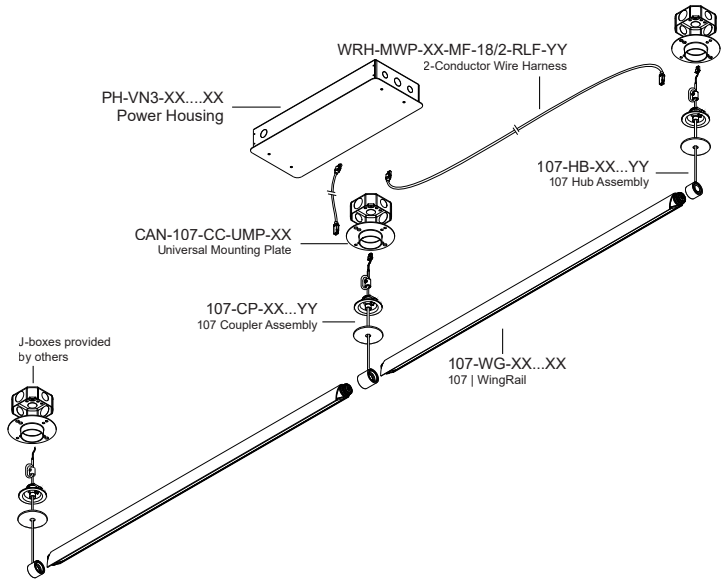
For Flexible 1 to 1 Power, Vode supplies one single output driver per fixture, allowing each fixture to be controlled independently. Direct/Indirect fixtures are supplied with two single output drivers, allowing the direct and indirect lighting to be controlled independently. Consult ***Power Guide*** to determine which type you will receive.



Optimized Power

To optimize power, Vode configures specifications with drivers that have 2 or 4 outputs. Depending on system configurations and power requirements, up to 4 fixtures can be powered from a 4-output driver. Consult ***Power Guide*** to determine which type you will receive.

IMPORTANT: Each fixture will still require individual wire harnesses, as shown below.



Note: Drawings not to scale, for reference only.

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Finish

Clear Anodized Finish



Clear Anodized Rail, White Canopy/ Clear Anodized Integral Power, White Cable

White Powder Coat Finish



White Rail, White Canopy/Integral Power, White Cable

Black Anodized Finish

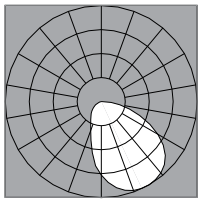


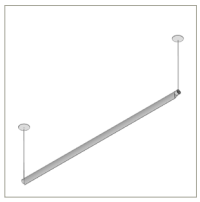
Black Rail, Black Canopy/Integral Power, Black Cable

Performance | Zipper Board Optics

Button Board Optics design has 72 diodes per foot (305mm).

White Baffle with EdgeSoft(WB)



L80 >60,000 hours

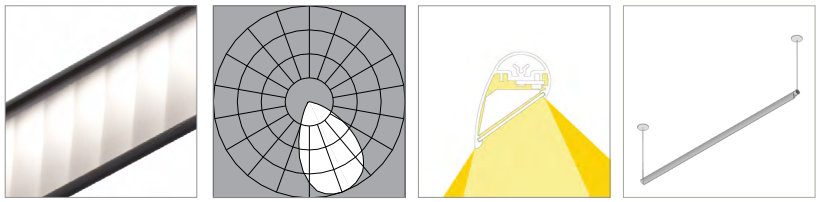
	80 CRI (80min., 84 avg.)				**90 CRI** (90min., 96 avg.)			
Low Output (LO)	2700K	3000K	3500K	4000K	2700K	3000K	3500K	4000K
Efficacy - Lumens per Watt	75	77	78	80	64	66	68	69
Lumens per foot (305mm)	277	285	291	297	239	246	251	256
Watts per foot (305mm)	3.8	3.8	3.8	3.8	3.8	3.8	3.8	3.8
Standard Output (SO)								
Efficacy - Lumens per Watt	92	95	97	99	80	82	84	85
Lumens per foot (305mm)	553	571	583	594	477	492	502	512
Watts per foot (305mm)	6.1	6.1	6.1	6.1	6.1	6.1	6.1	6.1
High Output (HO)								
Efficacy - Lumens per Watt	86	89	90	92	74	77	78	80
Lumens per foot (305mm)	1052	1085	1107	1129	907	935	954	973
Watts per foot (305mm)	12.4	12.4	12.4	12.4	12.4	12.4	12.4	12.4

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Performance | Zipper Board Optics

Button Board Optics design has 72 diodes per foot (305mm).

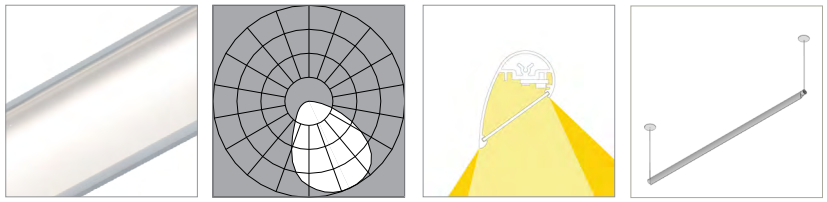
Black Baffle with EdgeSoft (BB)



L80 >60,000 hours

	80 CRI (80min., 84 avg.)				**90 CRI** (90min., 96 avg.)			
Low Output (LO)	2700K	3000K	3500K	4000K	2700K	3000K	3500K	4000K
Efficacy - Lumens per Watt	46	48	48	49	40	41	42	43
Lumens per foot (305mm)	170	176	179	183	147	151	155	158
Watts per foot (305mm)	3.8	3.8	3.8	3.8	3.8	3.8	3.8	3.8
Standard Output (SO)								
Efficacy - Lumens per Watt	57	59	60	61	49	51	52	53
Lumens per foot (305mm)	341	351	359	366	294	303	309	315
Watts per foot (305mm)	6.1	6.1	6.1	6.1	6.1	6.1	6.1	6.1
High Output (HO)								
Efficacy - Lumens per Watt	53	55	56	57	46	47	48	49
Lumens per foot (305mm)	647	668	681	695	558	576	587	599
Watts per foot (305mm)	12.4	12.4	12.4	12.4	12.4	12.4	12.4	12.4

Clear with EdgeSoft (C1)



L80 >60,000 hours

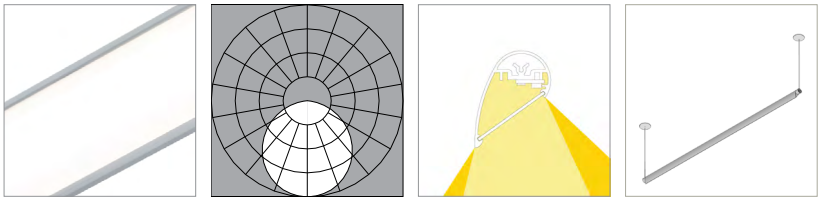
	80 CRI (80min., 84 avg.)				**90 CRI** (90min., 96 avg.)			
Low Output (LO)	2700K	3000K	3500K	4000K	2700K	3000K	3500K	4000K
Efficacy - Lumens per Watt	91	94	96	97	78	81	82	84
Lumens per foot (305mm)	337	348	355	362	291	300	306	312
Watts per foot (305mm)	3.8	3.8	3.8	3.8	3.8	3.8	3.8	3.8
Standard Output (SO)								
Efficacy - Lumens per Watt	112	116	118	121	97	100	102	104
Lumens per foot (305mm)	675	696	710	724	582	600	612	624
Watts per foot (305mm)	6.1	6.1	6.1	6.1	6.1	6.1	6.1	6.1
High Output (HO)								
Efficacy - Lumens per Watt	105	108	110	112	90	93	95	97
Lumens per foot (305mm)	1282	1322	1349	1376	1105	1140	1163	1187
Watts per foot (305mm)	12.4	12.4	12.4	12.4	12.4	12.4	12.4	12.4

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Performance | Zipper Board Optics

Button Board Optics design has 72 diodes per foot (305mm).

Diffuse (D1)



L80 is >60,000 hours

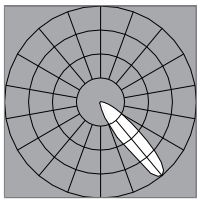
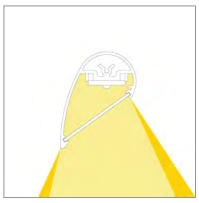
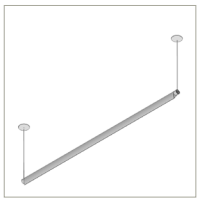
	80 CRI (80min., 84 avg.)				90 CRI (90min., 96 avg.)			
Low Output (LO)	2700K	3000K	3500K	4000K	2700K	3000K	3500K	4000K
Efficacy - Lumens per Watt	65	67	69	70	56	58	59	61
Lumens per foot (305mm)	243	250	255	261	209	216	220	225
Watts per foot (305mm)	3.8	3.8	3.8	3.8	3.8	3.8	3.8	3.8
Standard Output (SO)								
Efficacy - Lumens per Watt	82	84	86	88	71	73	74	76
Lumens per foot (305mm)	489	505	515	525	442	435	444	453
Watts per foot (305mm)	6.1	6.1	6.1	6.1	6.1	6.1	6.1	6.1
High Output (HO)								
Efficacy - Lumens per Watt	76	79	80	82	66	68	69	71
Lumens per foot (305mm)	934	964	984	1003	806	831	848	865
Watts per foot (305mm)	12.4	12.4	12.4	12.4	12.4	12.4	12.4	12.4

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Performance | Button Board Optics

Button Board Optics design has 72 diodes per foot (305mm).

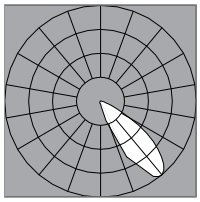
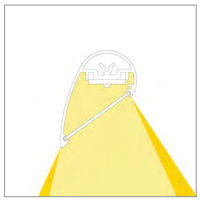
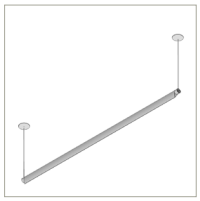
19º x 48º Oval (19)

L80 >70,000 hours

	80 CRI (80min., 84 avg.)			
Standard Output (SO)	2700K	3000K	3500K	4000K
Efficacy - Lumens per Watt	57	59	62	64
Lumens per foot (305mm)	420	438	456	474
Watts per foot (305mm)	7.3	7.3	7.3	7.3
High Output (HO)				
Efficacy - Lumens per Watt	50	52	55	57
Lumens per foot (305mm)	636	662	690	717
Watts per foot (305mm)	12.6	12.6	12.6	12.6

36º Medium (36)

L80 >70,000 hours

	80 CRI (80min., 84 avg.)			
Standard Output (SO)	2700K	3000K	3500K	4000K
Efficacy - Lumens per Watt	64	67	70	73
Lumens per foot (305mm)	476	496	516	537
Watts per foot (305mm)	7.3	7.3	7.3	7.3
High Output (HO)				
Efficacy - Lumens per Watt	57	60	63	65
Lumens per foot (305mm)	724	754	786	817
Watts per foot (305mm)	12.6	12.6	12.6	12.6

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Project		Catalog #		Type	
Prepared by		Notes		Date	



Fail-Safe

FVS4

High Abuse / Vandal Resistant
4" Wide / 3.75" Deep
2', 3', 4', 8' Lengths
Polycarbonate Lens
Surface, Ceiling or Wall

Typical Applications:

Vandal Resistant • Schools • Dormitories • Hallways • Locker Rooms • Showers • Canopies • Public Spaces • Maintenance Facilities • Mezzanines • Stairwells • Restrooms • Storage Facilities • Behavioral Health

Interactive Menu

- Order Information page 2
- Product Specifications page 2
- Product Warranty

Product Certification

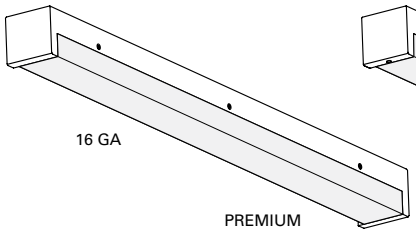
Top Product Features

Product Features

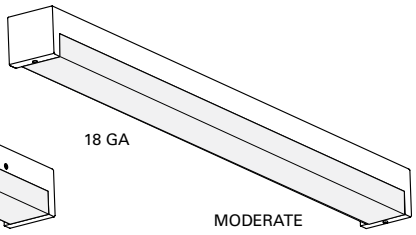
- Cold-rolled steel or stainless steel housing available
- 4" nominal width, 3.75" depth - 2', 3', 4', and 8' lengths
- Damp location standard; wet location under covered ceiling available
- Continuous row utilziing end knock-outs
- 16 ga. steel housing (FVSP) for durability. 18 ga. steel FVSM standard
- Internal occupancy sensor available, behind the lens
- Opal smooth or clear prismatic polycarbonate lens. Lifetime lens warranty. IK10 impact resistance rating.
- Damp location standard; wet location under covered ceiling available
- Options to meet Buy American Act requirements
- **Ligature resistant**; ceiling mount
- 10-Day Quick Spec available. Ship 10 days from receipt of PO

Dimensional and Mounting Details

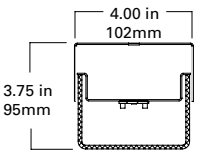
FVS4P



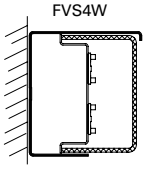
FVS4M



CEILING or WALL MOUNT
FVS4



WALL MOUNT
FVS4W



FVS4P	
Length	# Screws each side
2'	2
3'	2
4'	3
8'	5

Housing	FVS4P	FVS4M
	16GA Steel	18GA Steel
Listing	UL Damp, Wet Optional	UL Damp, Wet Optional
Construction	Screws along fixture edge	Set Screws on Endcaps

additional product diagrams

Fail-Safe FVS4

Order Information

SAMPLE NUMBER: **FVS4WM-8-LD4-2STD-35-UNV-OPL-EDC1-EL7W**
SAMPLE NUMBER: **FVS4P-4-LD4-2STD-30-120-P187-EDC1-OS1-WL**
10-DAY QUICK SPEC SAMPLE NUMBER: **QS-FVS4M-4-LD4-1HI-35-UNV-P125-EDC1** **Gray bar denotes available with 10-Day Quick Spec**

Domestic Preferences | Product Family | | Length | LED | No. of LEDs | Illumination Level

Domestic Preferences (7)	Product Family		Length	LED	No. of LEDs	Illumination Level
[Blank]=Standard **BAA**=Buy American Act	**FVS4**=High Abuse 4" Wide Surface Luminaire **QS-FVS4**=High Abuse 4" Wide Surface Luminaire, Quick Spec (8) **FVS4W**=High Abuse 4" Wide Surface Wall Mount Luminaire	**M**=Moderate **P**=Premium	**2**=2' length (4), (6) **3**=3' length **4**=4' length **6**=6' length	**LD4**=Linear LED, Version 4	**1**=1 row LED module in X-section **2**=2 rows LED module in X-section (1), (4)	**LO**=Low **STD**=Standard **HI**=High
Notes (7) Only product configurations with this designated prefix are built to be compliant with the Buy American Act of 1933 (BAA). Please refer to DOMESTIC PREFERENCES website for more information. Components shipped separately may be separately analyzed under domestic preference requirements.	**Notes** (8) 10 day ship, from receipt of clean PO to ship date. 25 unit maximum per PO. QS available only with shaded options. EL14W only available with QS as 4ft length with 1LO, 1STD, 1HI.		**Notes** (4) 2HI with 2 circuits not available in 2ft length. (6) 2' length fixture with 2 circuits and OS1 or OS2 is not available.		**Notes** (1) Up to 1HI only with Emergency Battery Pack. 1LO, 1STD, 1HI available with EL7W and EL14W. 2 LED cross-section not available. (4) 2HI with 2 circuits not available in 2ft length.	

Color Temperature | Voltage | Lens | Driver | Options | Finish

Color Temperature	Voltage	Lens	Driver	Options	Finish
30=3000K **35**=3500K **40**=4000K **50**=5000K	**120**=120 Volt **277**=277 Volt **UNV**=120-277 Volt	**P125=**.125" Clear polycarbonate prismatic lens **P187=**.187" Clear polycarbonate prismatic lens **OPL=** .125" Polycarbonate smooth opal lens	**EDC1**=Electronic driver, Non-Dimming, 1 circuit **EDC2**=Electronic driver, Non-Dimming, 2 circuits **EDD1**=Electronic driver, Dimming 10%, 1 circuit **EDD2**=Electronic driver, Dimming 10%, 2 circuits **ED1D1**=Electronic driver, Dimming 1%, 1 circuit **ED1D2**=Electronic driver, Dimming 1%, 2 circuits	**EL7W**=7 watt EM Pack (1), (2) **EL14W**=14 watt EM Pack (1), (2), (8) **SHP**=Stainless steel, painted housing **SHB**=Stainless steel, brushed housing **OS1**=Internal Occupancy Sensor (behind lens), connected to one LED module. Specify 120 or 277 voltage. (5), (6) **OS2**=Internal Occupancy Sensor (behind lens), connected to two LED modules. Specify 120 or 277 voltage. (5), (6) **WL**=Wet location, listed under covered ceiling for FVS4P and FVS4M. WL not available on FVS4WP or FVS4WM. **90**=90CRI (not available in 3ft length).	**[Blank]**=Matte White **BK**=Black **DP**=Dark Platinum **GW**=Gloss White **AM**=Anti-microbial Matte White
				Notes (1) Up to 1HI only with Emergency Battery Pack. 1LO, 1STD, 1HI available with EL7W and EL14W. 2 LED cross-section not available. (2) EL7W not available in 2ft length. EL14W not available in 2ft or 3ft length. (5) OS1 and OS2 require 120 or 277 to be specified in the ordering logic. (6) 2' length fixture with 2 circuits and OS1 or OS2 is not available.	**Notes** Custom colors available, with customer provided RAL number. Consult Technical Support with any questions.

Product Specifications

Fasteners
- **FVSP** - Captive, stainless steel, countersunk, flush, tamperproof, T20 TORX ®-head screws prevent unauthorized access. Screw heads painted to match housing color/finish.
- **FVSM** - 2 white T20 TORX screws prevent unauthorized access.

Housing
- Die-formed 16 ga. Steel (FVS4P), 18 ga. Steel (FVS4M) with welded and ground ends. Stainless steel housing available.

Finish
- Matte white electrostatically applied, white powder coat finish.
- Gloss white and anti-microbial white painted finish available.

Gasket
- Concealed, polyurethane end gaskets inhibit the entrance of environmental contaminants.

Lens
- Nominal 0.125", UV stabilized, clear Pattern 12, impact-resistant, prismatic polycarbonate refractor for high efficiency, low surface brightness and maximum strength. Opal smooth available. .187" thick clear Pattern 12 prismatic polycarbonate available.
- Lifetime Lens Warranty.

LEDs
- Available with 3000K, 3500K,4000K, 5000K with minimum of 80CRI. 90 CRI available (except 3' length)
- Projected life is 50,000 hours at 70% lumen maintenance.

Lens Retention
- The FVS4P double wall lens channel captivates lens to prevent unauthorized fixture penetration. Screws along each side to ensure maximum lens captivation. FVS4M incorporates (2) tamper resistant screws, one on each endcap.

Transformer/Driver
- Electronic driver 120V-277V, 0-10V, dimming standard.

Compliance
- UL listed for damp location. Wet location listed under covered ceiling optional, FVS4P & FVS4M.

Warranty
- 5 Year warranty on LED's and electrical.
- Fail-Safe will repair or replace any vandal resistant / high abuse luminaire, that is deemed non-funcational due to physical damage to the luminaire exterior housing or polycarbonate lens. The luminaire must be installed correctly, and the warranty does not include any interior component, nor does it include damage due to gunfire, paint, caustic material / chemicals, disastrous or abnormal events.

Fail-Safe FVS4

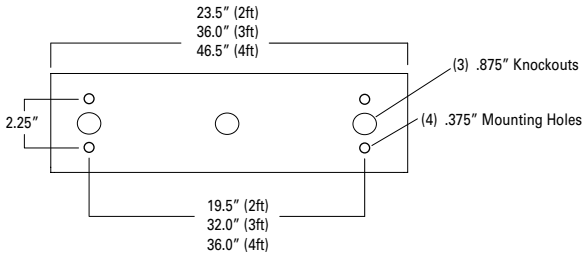
Nominal Input Watts

View IES files

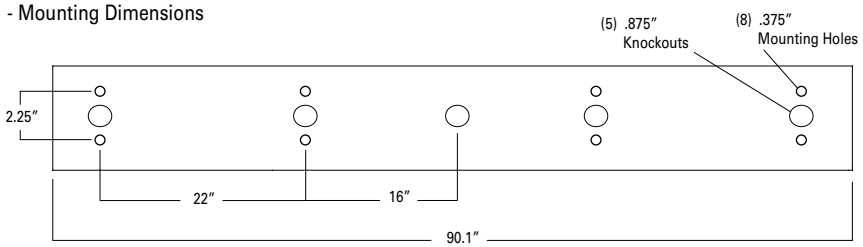
LENGTH	# Modules in Cross-Section	Illumination Level	Nominal Input Watts	Color Temp	LENS P125 Nominal Delivered Lumens	LENS P187 Nominal Delivered Lumens	LENS OPL Nominal Delivered Lumens
2'	1	LO	12.3	30 35 40 50	1266 1290 1316 1434	1230 1254 1279 1394	849 865 882 961
	1	STD	16.9	30 35 40 50	1723 1756 1791 1952	1675 1707 1741 1897	1155 1177 1201 1309
	1	HI	22.2	30 35 40 50	2125 2166 2209 2408	2065 2105 2147 2340	1425 1452 1481 1614
	2	LO	24.1	30 35 40 50	2614 2664 2717 2962	2540 2588 2640 2878	1648 1679 1713 1867
	2	STD	33.9	30 35 40 50	3475 3541 3612 3937	3376 3440 3509 3825	2190 2232 2277 2482
	2	HI	44.8	30 35 40 50	4266 4347 4434 4833	4145 4223 4308 4696	2689 2740 2795 3047
3'	1	LO	21.3	30 35 40 50	2384 2429 2478 2701	2254 2296 2343 2553	1545 1574 1606 1751
	1	STD	28.5	30 35 40 50	3067 3125 3188 3475	2899 2954 3014 3285	1988 2025 2066 2252
	1	HI	36.3	30 35 40 50	3699 3770 3845 4191	3497 3564 3635 3962	2397 2442 2492 2716
	2	LO	56.8	30 35 40 50	5909 6022 6142 6695	5575 5682 5795 6317	3567 3635 3708 4042
	2	STD	64.0	30 35 40 50	6545 6671 6804 7416	6175 6294 6420 6997	3951 4027 4107 4477
	2	HI	71.7	30 35 40 50	7136 7273 7418 8086	6733 6862 6999 7629	4308 4390 4478 4881
4'	1	LO	23.6	30 35 40 50	2594 2643 2696 2939	2515 2563 2614 2850	1707 1739 1774 1934
	1	STD	33.6	30 35 40 50	3476 3542 3613 3938	3370 3434 3503 3818	2287 2330 2377 2591
	1	HI	44.5	30 35 40 50	4274 4356 4443 4843	4144 4224 4308 4696	2812 2866 2923 3186
	2	LO	57.4	30 35 40 50	6015 6130 6253 6816	5848 5960 6080 6627	3756 3828 3905 4256
	2	STD	67.5	30 35 40 50	6853 6984 7124 7765	6663 6791 6927 7550	4279 4361 4448 4849
	2	HI	89.3	30 35 40 50	8335 8494 8664 9444	8104 8259 8424 9182	5205 5304 5410 5897

Dimensional and Mounting Details

2',3',4' - Mounting Dimensions



8' - Mounting Dimensions

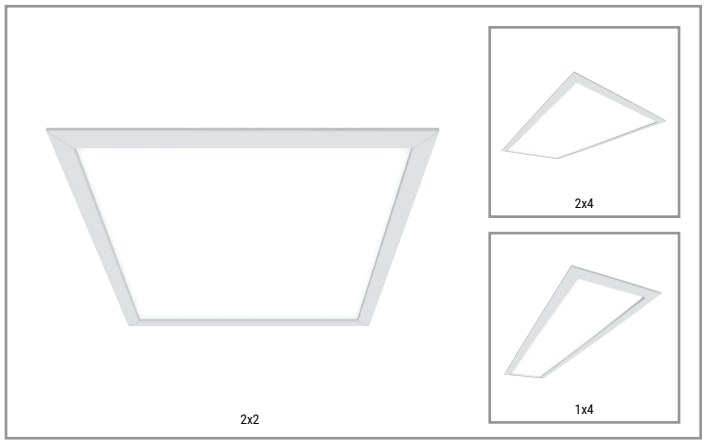


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Specifications and dimensions
subject to change without notice.

L5A
L5B
L5C

Project		Catalog #		Type	
Prepared by		Notes		Date	



Metalux

CGT

LED Backlit Panel

Typical Applications

Offices • Education • Healthcare • Retail

Interactive Menu

- Order Information page 2
- Photometric Data page 4
- Product Warranty

Product Certification

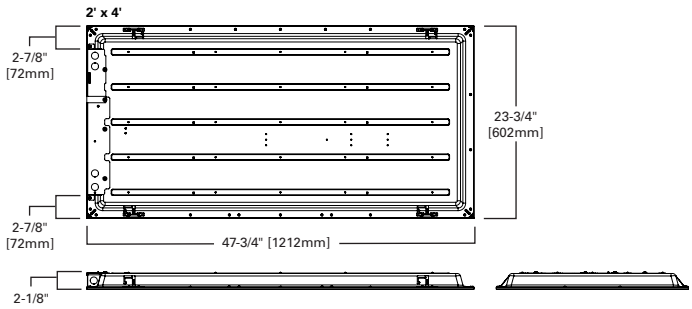
Product Features

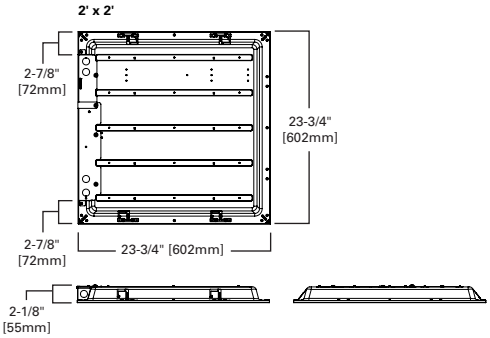
damp location

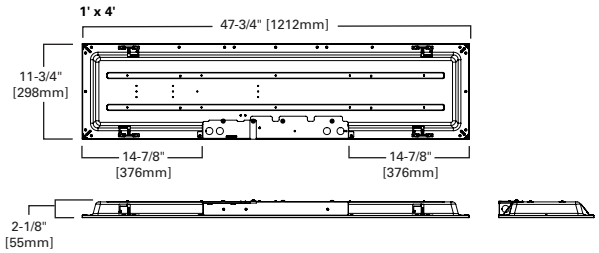
Top Product Features

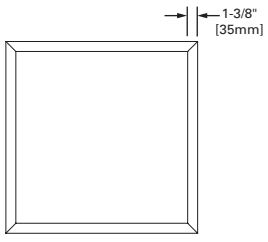
- Steel housing is post-painted to increase efficacy, facilitate installation, and inhibit corrosion
- Acrylic micro-optics provide uniform illumination across the entire lens
- Extruded aluminum door frame with welded and ground mitered corners, tightly seals to the housing for optimal performance and aesthetics
- 2-1/8" overall height ideal for shallow plenums
- Projected lumen maintenance based on TM21 testing standards is >L84, @60,000 hours

Dimensional and Mounting Details









Ordering Information/Performance

UNV (120-277)

Catalog	Size	UPC	CCT	CRI (Min)	Delivered Nominal Lumens	Watts		Efficacy (lm/W)		Input Current (A)	
						120V	277V	120V	277V	120V	277V
14CGT4035C	1x4	080083879526	3500K	80	4189	39.4	38.8	106	108	0.33	0.15
14CGT4040C		080083879540	4000K	80	4351			110	112		
14CGT4050C		080083879861	5000K	80	4351			110	112		
22CGT3535C		080083880003	3500K	80	3449			110	109		
22CGT3540C	2x2	080083880027	4000K	80	3582	31.4	31.7	114	113	0.2	0.09
22CGT3550C		080083880041	5000K	80	3582			114	113		
24CGT4535C	2x4	080083880089	3500K	80	4268	38.8	38	110	112	0.33	0.15
24CGT4540C		080083880102	4000K	80	4432			114	117		
24CGT4550C		080083880126	5000K	80	4432			114	117		
24CGT5535C		080083880164	3500K	80	5139	46.8	46.4	110	111	0.39	0.18
24CGT5540C		080083880188	4000K	80	5337			114	115		
24CGT5550C		080083880201	5000K	80	5337			114	115		

* All SKUs stocked in multiple North American DC's.

347V

Catalog	Size	UPC	CCT	CRI (Min)	Delivered Nominal Lumens	Watts	Efficacy (lm/W)	Input Current (A)
14CGT4035C-347	1x4	080083880249	3500K	80	4190	39.9	105	0.11
14CGT4040C-347		080083880263	4000K	80	4351		109	
14CGT4050C-347		080083880287	5000K	80	4351		109	
22CGT3535C-347	2x2	080083880409	3500K	80	3449	32.6	106	0.09
22CGT3540C-347		080083880423	4000K	80	3582		110	
22CGT3550C-347		080083880454	5000K	80	3582		110	
24CGT4535C-347	2x4	080083880492	3500K	80	4268	37.9	113	0.11
24CGT4540C-347		080083880515	4000K	80	4432		117	
24CGT4550C-347		080083880539	5000K	80	4432		117	
24CGT5535C-347		080083880577	3500K	80	5139	46.7	110	0.13
24CGT5540C-347		080083880591	4000K	80	5337		114	
24CGT5550C-347		080083880614	5000K	80	5337		114	

* All SKU's stocked at Canada DC(s). 347V SKUs not available at Elk Grove Village.

Options

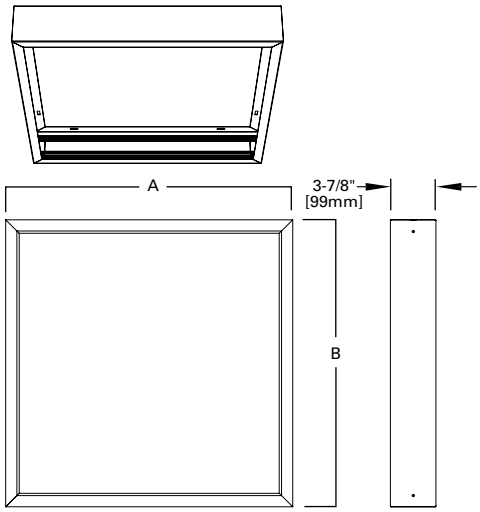
Catalog	Description	Example	Notes
EL7W (1)	7W EM Pack, Installed	22CGT3540-EL7W	Remote Indicator/Test Switch
EL14W (1)	14W EM Pack, Installed	14CGT4040C-EL14W	Remote Indicator/Test Switch
A3/8-4/18GDIM	6' Length, 3/8" Cable, 2 Wire, 2 Dimming Leads, Ground	24CGT4535C-A3/8-4/18G DIM	
A3/8-5/18GDIM	6' Length, 3/8" Cable, 3 Wire, 2 Dimming Leads, Ground	24CGT5540C-A3/8-5/18G DIM	
EL7W-A3/8-5/18GDIM	7W EM Pack, Installed, and 6' Flex, 3/8" Cable, 3 Wire, 2 Dimming Leads, Ground	14CGT4050C-EL14W-A3/8-5/18GDIM 22CGT3535C-EL7W-A3/8-4/18GDIM	EL7W and EL14W can be used with any of the optional flex. EM pack is always specified before (to the left of) the flex, in the catalog number.
RMK2	1x4 Regress Mount Kit, Installed	14CGT-4050-RMK2	
	2x2 Regress Mount Kit, Installed	22CGT-4050-RMK2	
	2x4 Regress Mount Kit, Installed	24CGT-4050-RMK2	

Notes: (1) Factory installed with remote test switch/indicator/laser test. For approximate delivered lumens multiply the lumens per watt of the desired fixture by the wattage of the emergency battery pack (100 lm/W x 7=700 lumens). IES-format photometry for luminaire under emergency operation available. Battery option increases total height by 1 inch.

Surface Mounting Options [1]

Catalog No.	Description	UPC	A	B
CGTSURF24	2x4 CGT Surface Mount Kit	080083083107	24-5/8" [625mm]	48-5/8" [1235mm]
CGTSURF22	2x2 CGT Surface Mount Kit	080083083121	24-5/8" [625mm]	24-5/8" [625mm]
CGTSURF14	1x4 CGT Surface Mount Kit	080083083145	12-5/8" [321mm]	48-5/8" [1235mm]

Note: (1) Cannot be used with EL7W or EL14W options.



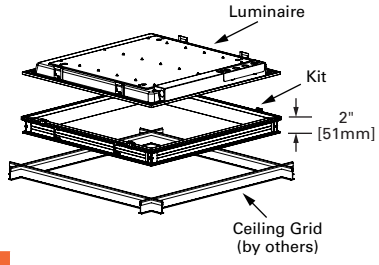
Drywall Frame Kit

Catalog No.	Description	UPC	Size
DF-24W-U	2x4 dry wall frame kit	0662401232970	2x4
DF-22W-U	2x2 dry wall frame kit	0662401232963	2x2
DF-14W-U	1x4 dry wall frame kit	0662401232949	1x4

Regress Mount Kit

Catalog No.	Description	UPC	Size
RMK2-14-W	1x4 Regress Mount Kit	080083288021	1x4
RMK2-22-W	2x2 Regress Mount Kit	080083287185	2x2
RMK2-24-W	2x4 Regress Mount Kit	080083288007	2x4

Regress Panel Field Assembly

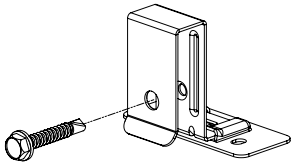


Suspension Kit

Catalog	UPC	Description
FPSUS24-B	080083876686	2 point Y-hanger suspension kit includes sleeved aircraft cable, carabiner, ceiling connection, SO cord, cord connectors and round 4" J-box cover plate
FPSUS24	080083258895	2 point Y-hanger suspension kit includes aircraft cable, carabiner, ceiling connection, SO cord, cord connectors and round 4" J-box cover plate
Mounting height from ceiling **Min.**=7-1/4" [184mm] **Max**.=27" [286mm]		

Ceiling Retention

Catalog	UPC
CGTEQ	080083083084
Required by some local codes. Order one set for each fixture (Four clips per kit)	



Shipping Data

	1x4	2x2	2x4
Product Weight (lb.)	7.3	6.8	11.9
Packaged Weight (lb.)	8.4	8.4	14.5
Pallet Qty	54	36	18
Pallet Size	52" x 40"	53" x 49"	

Load Data

THD	<15% THD
PF	>.94 PF

Product Specifications

Construction
- Robust die-formed steel back plate is post-painted to ensure durability
- Housing is absent of holes to resist debris/bug intrusion
- Aluminum door frame with mitered corners, tightly fastened to the housing

Mounting
- Integral grid clips provided and include suspension / wire retention features
- Grid clip includes fold up hang points. Use FPSUS24 or other desired suspension methods for direct suspension
- “Earthquake clip” accessories available
- Junction box constructed of code gauge galvanized steel with access plate
- Multiple Trade size KO provided and JBox is suitable for up to 12AWG wiring
- Surface and suspension kits available for use in grid or hard surfaces
- Factory installed flexible with dimming leads available

Controls
- Standard UNV 120 - 277V driver with 0-10V dimming, 10% standard
- Optional 347V driver with 0-10V dimming driver
- Can be used with tile mounted sensor or other remote mount controls

Electrical
- Projected lumen maintenance based on TM21 testing standards is >L84 @60,000 hours
- Driver rated for FCC part 15 Class B for use in residential or commercial applications
- LEDs are 80 CRI (minimum) and available in 3500K, 4000K, and 5000K CCT

Emergency Options
- 120V-277V integral emergency battery pack comes in 7-watts or 14-watts
- Constant power to the LED system for controlled, predictable discharge
- Remote indicator test switch
- Min. 90-minute backup period for code compliance

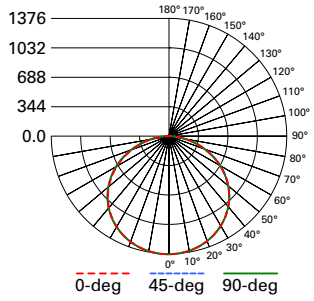
Optical Shielding
- Acrylic micro-optics enable uniform distribution of the LEDs for uniform lens illumination
- Frosted lens with smooth pattern delivers uniform illumination across the entire lens
- Durable lens with surface texture to minimize scratch and impact damage

Compliance
- cULus listed for 25C ambient environments, indoor applications
- IC rated for direct insulation contact
- Damp location listed
- IESNA LM-79 and LM-80 standards compliant
- DesignLights Consortium® Qualified and classified for DLC Standard, refer to www.designlights.org for details.
- Suitable for State of California Title 24 high efficacy luminaire
- FCC part 15 class B (residential) compliant
- Meets IP5X rating from the room side with no modification needed
- Fixture is rated for NSF/ANSI standard 2 - Light fixture for Splash Zone and Non-Food Zone

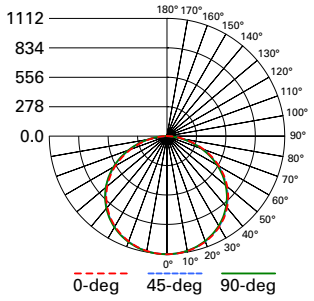
Warranty
- Five year warranty
- Extended warranty to 10 years available

Photometric Data

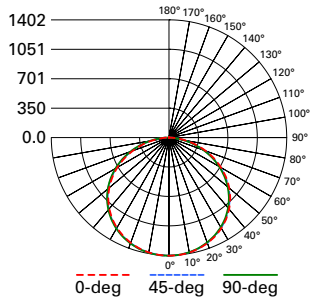
View IES files



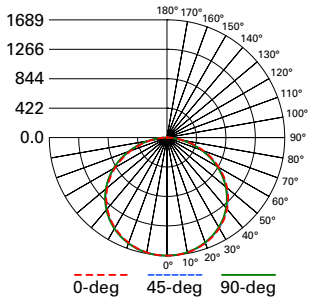
14CGT4040C
Electronic Driver
Linear LED 4000K
Spacing criterion: (II) 1.31 x mounting height, (⊥) 1.31 x mounting height
Lumens: 4351
Input Watts: 39.4W
Efficacy: 110.4 LPW
Test Report: 14CGT4040C.IES



22CGT3540C
Electronic Driver
Linear LED 4000K
Spacing criterion: (II) 1.32 x mounting height, (⊥) 1.32 x mounting height
Lumens: 3582
Input Watts: 31.4W
Efficacy: 114.1 LPW
Test Report: 22CGT3540C.IES



24CGT4540C
Electronic Driver
Linear LED 4000K
Spacing criterion: (II) 1.31 x mounting height, (⊥) 1.31 x mounting height
Lumens: 4432
Input Watts: 38.8W
Efficacy: 114.2 LPW
Test Report: 24CGT4540C.IES



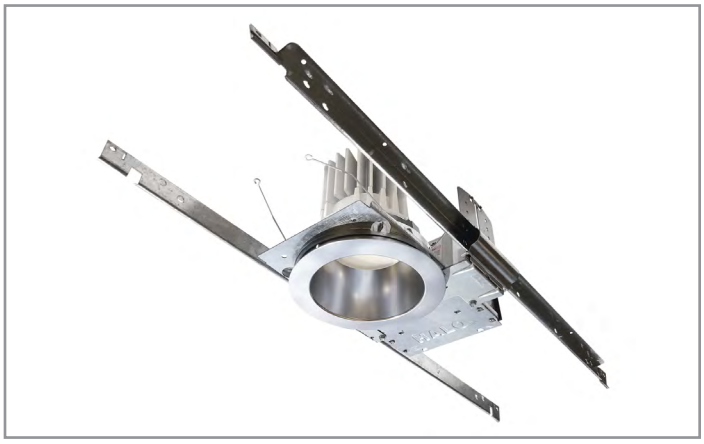
24CGT5540C
Electronic Driver
Linear LED 4000K
Spacing criterion: (II) 1.31 x mounting height, (⊥) 1.31 x mounting height
Lumens: 5337
Input Watts: 46.8W
Efficacy: 114.0 LPW
Test Report: 24CGT5540C.IES

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Peachtree City, GA 30269
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www.cooperlighting.com

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Specifications and dimensions subject to change without notice.

Project		Catalog #		Type	
Prepared by		Notes		Date	



HALO Commercial

HC4 | HM4 | 41/41PS

4-inch LED downlight and wall wash

Typical Applications

Office • Healthcare • Hospitality • Institutional • Mixed-Use/Retail

Interactive Menu

- Order Information page 2
- Product Specifications page 4
- Photometric Data page 5
- Energy & Performance Data page 8
- Connected Systems page 10
- Product Warranty

Product Certification

ENERGY STAR · Efficiency Standards T24 Can be used to comply with California Title 24 Non-Residential · wet location · Chicago Plenum Approved · FC · RoHS Compliant · UL Certified

Product Features

QS Quick Spec · Showerlight

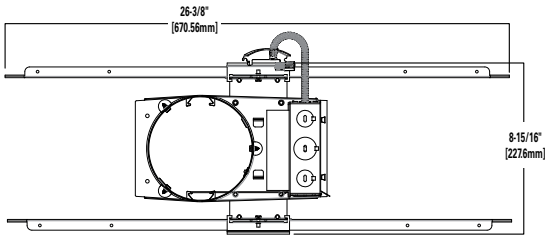
Control Compatibility

WaveLinx LITE · WaveLinx PRO

Top Product Features

- New construction/remodel series; 500 to 6,000 lumens
- Narrow, Medium and Wide distributions; Wall wash with rotatable linear spread lens
- 2700K, 3000K, 3500K, 4000K and 5000K CCT; 80 or 90 CRI
- Universal voltage 120V-277V; Standard 0-10V driver dims to 1%
- Mounting frame converts to remodel that installs from below the ceiling
- Quick Spec emergency backup mounting frames - fast delivery option

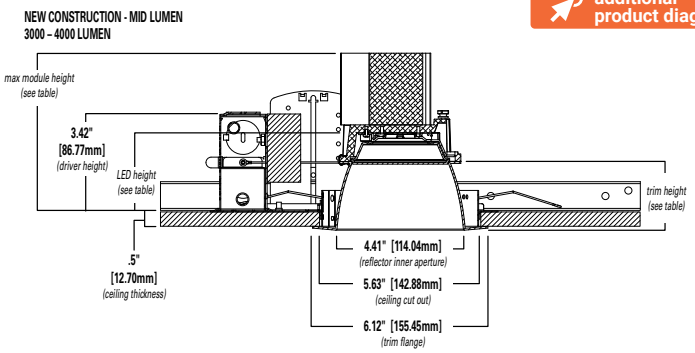
Dimensional and Mounting Details



Mid Lumen (3000 – 4000 Lumens)

Distribution	Max. Module Height	Trim Height	LED Height
Narrow	5.6"	2.5"	2.9"
Medium	5.7"	2.6"	3.0"
Wide	5.5"	2.4"	2.8"
Baffle	5.5"	2.4"	2.8"

additional product diagrams



Mounting Frame Order Information

Sample Number : HC420D010REM7 - HM40525930 - 41MDC

A complete luminaire consists of a housing frame, LED module, and reflector (ordered separately)

Mounting Frame	Lumens	Driver Options	Factory Installed Emergency & Connected Lighting Options	Accessories (Order & Install Separately)
HC4 = 4" new construction downlight housing **HC4CP** = 4" new construction housing, Chicago Plenum - CCEA compliant	**05** = 500 lm **07** = 750 lm **10** = 1000 lm **15** = 1500 lm **20** = 2000 lm **25** = 2500 lm **30** = 3000 lm **35** = 3500 lm **40** = 4000 lm **45** = 4500 lm (7) **50** = 5000 lm (7) **55** = 5500 lm (7) **60** = 6000 lm (7)	**D010**=UNV 120-277V, 50/60Hz, 0-10V 1%-100% dimming at 120-277V on 0-10V controls **Canada Option 500-5000 lumens:** **D010347** = 347VAC 50/60Hz 0-10V 1%-100% dimming. For 500, 750, 1000, 1500, 2000, 2500, 3000, 3500, 4000, 4500, 5000lm models only (1) **Canada Option 5500-6000 lumens:** **D010X347** = step down transformer factory installed (with standard "D010" 120V-277V LED driver). For 5500, 6000lm models only (1)	**REM7** = 7 watt emergency battery pack with remote test / indicator light, use with D010 only (1) (2) (6) **REM14** = 14 watt emergency battery pack with remote test / indicator light, use with D010 only (1) (2) (6) **IEM7** = 7 watt emergency battery pack with integral test / indicator light, use with D010 only (1) (2) (6) (10) **IEM14** = 14 watt emergency battery pack with integral test / indicator light, use with D010 only (1) (2) (6) (10) **BOD7ST** = 7.5 watt Bodine self-test emergency battery pack with remote test / indicator light, use with D010 only (1) (2) (6) **WTA** = Factory WaveLinx PRO Tilemount Sensor Kit (4) **WTK** = Factory WaveLinx LITE Tilemount Sensor Kit (5) **WPN** = WaveLinx PRO Wireless Node without Sensor (11) **WLN** = WaveLinx LITE Wireless Node without Sensor (12)	**HB128APK** = L channel hanger bar, 26", pair (replacement) **RMB22** = Adjustable wood joist mounting bars, pair, extend to 22" long **H347** = 347 to 120V step down transformer, 75VA **H347200** = 347 to 120V step down transformer, 200VA **WTA** = Field WaveLinx PRO Tilemount Sensor Kit (4) **WTK** = Field WaveLinx LITE Tilemount Sensor Kit (5)
		DLV = Distributed Low Voltage dimming driver 1%-100%, 1000-4000 lumens only. For use with DLVP system only, refer to DLVP specifications for details. (1)	**REMV7** = 7 watt emergency battery pack with remote test / indicator light, use with DLV only (1) (2) (3) (6) **REMV14** = 14 watt emergency battery pack with remote test / indicator light, use with DLV only (1) (2) (3) (6) **IEMV7** = 7 watt emergency battery pack with integral test / indicator light, use with DLV only (1) (2) (3) (6) (10) **IEMV14** = 14 watt emergency battery pack with integral test / indicator light, use with DLV only (1) (2) (3) (6) (12)	
Notes	**Notes**	**Notes**	**Notes**	**Notes**
	(7) Marked Spacing: Center to Center of Adjacent Luminaires = 36" Center of Luminaire to Building Member = 18" Minimum overhead = 0.5	(1) Not available with CP models	(1) Not available with CP models (2) Not available with D010347 (347V models) (3) ULus for U.S. only (4) WTA = WaveLinx PRO tilemount sensor kit for daylight dimming, PIR motion sensing, and optional RLTS - Real Time Location Services, use with D010 only (Refer to WaveLinx specifications) (5) WTK = WaveLinx LITE tilemount sensor kit for daylight dimming, PIR motion sensing, use with D010 only (Refer to WaveLinx LITE specifications) (6) Emergency battery backup options are Non-IC only, and rated for a minimum starting temperature of 0°C (10) IEM option requires compatible IEM reflector or baffle trim. See Trim Ordering below. (11) WPN = WaveLinx PRO wireless node provides luminaire-level control with scene and zone configuration without an integrated sensor; Connects wirelessly with daylight dimming sensor and PIR motion sensor if desired. Use with 0-10V driver only. Not compatible with 347V or Chicago plenum. (Refer to WaveLinx PRO specifications.) (12) WLN = WaveLinx LITE wireless node provides luminaire-level control with scene and zone configuration without an integrated sensor; Connects wirelessly with daylight dimming sensor and PIR motion sensor if desired. Use with 0-10V driver only. Not compatible with 347V or Chicago plenum. (Refer to WaveLinx LITE specifications.)	(4) WTA = WaveLinx PRO tilemount sensor kit for daylight dimming, PIR motion sensing, and optional RLTS - Real Time Location Services, use with D010 only. (Refer to WaveLinx PRO specifications.) (5) WTK = WaveLinx LITE tilemount sensor kit for daylight dimming, PIR motion sensing, use with D010 only. (Refer to WaveLinx LITE specifications.)

Quick Spec Emergency Mounting Frame Order Information

Sample Number :

Quick Spec Emergency Mounting Frame: RR-HC420D010REM7

LED module and reflectors are ordered separately.

Order separately: LED Module: HM40525835 | Reflector: 41MDC

Select from the Quick Spec Mounting Frame ordering information to receive the *Fast Delivery* option for the frame.

Quick Spec Code	Mounting Frame	Lumens	Driver Options	Factory Installed Emergency Options	Accessories (Order & Install Separately)
RR = East Region **BRR** = West Region	**HC4** = 4" new construction downlight housing	**10** = 1000 lm **15** = 1500 lm **20** = 2000 lm **30** = 3000 lm **40** = 4000 lm	**D010**=UNV 120-277V, 50/60Hz, 0-10V 1%-100% dimming at 120-277V on 0-10V controls	**REM7** = 7 watt emergency battery pack with remote test / indicator light, use with D010 only (2) (6) **REM14** = 14 watt emergency battery pack with remote test / indicator light, use with D010 only (2) (6) **IEM7** = 7 watt emergency battery pack with integral test / indicator light, use with D010 only (2) (6) (10) **IEM14** = 14 watt emergency battery pack with integral test / indicator light, use with D010 only (2) (6) (10)	**HB128APK** = L channel hanger bar, 26", pair (replacement) **RMB22** = Adjustable wood joist mounting bars, pair, extend to 22" long
	Notes	**Notes**	**Notes**	**Notes**	**Notes**
				(2) Not available with D010347 (347V models) (6) Emergency battery backup options are Non-IC only, and rated for a minimum starting temperature of 0°C (10) IEM option requires compatible IEM reflector or baffle trim. See Trim Ordering below.	

LED Module Order Information

LED Module Lumens CRI/CCT

LED Module	Lumens	CRI/CCT	
HM4 = 4" LED module	**0525** = 500 - 2500 lumen **3040** = 3000-4000 lumen **4560** = 4500-6000 lumen	**827** = 80CRI, 2700K **830** = 80CRI, 3000K **835** = 80CRI, 3500K **840** = 80CRI, 4000K **850** = 80CRI, 5000K	**927** = 90CRI, 2700K **930** = 90CRI, 3000K **935** = 90CRI, 3500K **940** = 90CRI, 4000K **950** = 90CRI, 5000K
Notes	**Notes**	**Notes**	

Trim Order Information

Reflector	Distribution[8]	Finish	Flange	Accessories
41 = 4" conical reflector	**ND** = narrow 50° beam angle 0.84 SC (nominal) **MD** = medium 60° beam angle 1.00 SC (nominal) **WD** = wide 75° beam angle 1.24 SC (nominal) **RWW** = rotatable wall wash with linear spread lens	**C** = Specular clear **H** = Semi-specular clear **W** = White	**Blank** = Polished flange standard with C & H reflectors **Blank** = White flange standard with W reflector **WF** = White flange option available with C & H reflectors	**41RWWPK** = Replacement part kit - wall wash lens insert - for use with 41RWW* only.
Notes	**Notes**	**Notes**	**Notes**	**Notes**
	(8) Values are nominal for white reflector, others may vary.			

Baffle	Distribution[8]	Finish	Flange	Accessories
41 = 4" baffle reflector	**WD** = wide 75° beam angle 1.24 SC (nominal) **RWW** = rotatable wall wash with linear spread lens	**BB** = Black baffle **WB** = White baffle	**Blank** = White flange standard with BB, & WB **BF** = Black flange option available with BB	**41RWWPK** = Replacement part kit - wall wash lens insert - for use with 41RWW* only.
Notes	**Notes**	**Notes**	**Notes**	**Notes**
	(8) Values are nominal for white reflector, others may vary.			

Reflector	Distribution[8]	Finish	Flange
41PS = 4" non-conductive polymer 'dead front' conical reflector [9]	**MD** = medium 60° beam angle 1.00 SC (nominal)	**W** = White	**Blank** = White flange standard with W reflector
Notes	**Notes**	**Notes**	**Notes**
(9) 41PS* is 1000-3000 lumens Non-IC rated. 500 & 750 lumens IC rated. 41PS is not for use over 3000 lumens in Non-IC or over 750 lumens in IC.	(8) Values are nominal for white reflector, others may vary.		

IEM Reflector	Distribution[8]	Finish	Flange	Integral Emergency
41 = 4" conical reflector for integral emergency only	**ND** = narrow 50° beam angle 0.84 SC (nominal) **MD** = medium 60° beam angle 1.00 SC (nominal) **WD** = wide 75° beam angle 1.24 SC (nominal)	**C** = Specular clear **H** = Semi-specular clear **W** = White	**Blank** = Polished flange standard with C & H reflectors **Blank** = White flange standard with W reflector **WF** = White flange option available with C & H reflectors	**IEM** = Reflector for use with integral emergency housings only. Provides access hole for integral emergency test switch.
Notes	**Notes**	**Notes**	**Notes**	**Notes**
	(8) Values are nominal for white reflector, others may vary.			

IEM Baffle	Distribution[8]	Finish	Flange	Integral Emergency
41 = 4" baffle reflector for integral emergency only	**WD** = wide 75° beam angle 1.24 SC (nominal)	**BB** = Black baffle **WB** = White baffle	**Blank** = White flange standard with BB, & WB **BF** = Black flange option with BB	**IEM** = Reflector for use with integral emergency housings only. Provides access hole for integral emergency test switch.
Notes	**Notes**	**Notes**	**Notes**	**Notes**
	(8) Values are nominal for white reflector, others may vary.			

Product Specifications

Housing Frame
- Boat shaped galvanized steel plaster frame with adjustable plaster lip
- Accommodates 1/2" to 1-1/2" thick ceilings
- Installs in new construction or from below the finished ceiling (non-accessible) for remodeling
- Provided with two remodel clips to secure the frame to the ceiling

Universal Mounting Bracket
- Adjusts 2" vertically from above and below the ceiling
- Use with the included mounting bars or with 1/2" Electric Metallic Tube (EMT)
- Removable to facilitate remodeling installation from below the finished ceiling

Mounting Bars
- Captive pre-installed No Fuss™ mounting bars lock to T-grid with screwdriver or pliers
- Centering detents allow for consistent positioning of fixtures

LED Module
- Proximity phosphors over chip on board LEDs provide a uniform source with high efficiency and no pixilation
- Available in 80 or 90 color rendering index (CRI)
- Color accuracy within 3 SDCM provides color consistency and uniformity
- 90 CRI option: R9>50 (refer to chromaticity information for details)
- Available in 2700K, 3000K, 3500K, 4000K and 5000K correlated color temperature (CCT)
- Lumen options include 500, 750, 1000, 1500, 2000, 2500, 3000, 3500, 4000, 4500, 5000, 5500, 6000 lumens (nominal)
- Passive thermal management achieves 60,000 hours at 70% lumen maintenance (L70) in insulated ceilings (IC) and non-IC applications
- Integral diffuse lens provides visual shielding
- Integral connector allows quick connection to housing flex

Reflector
- Self-flanged aluminum reflectors available in narrow, medium or wide distribution patterns
- Medium distribution polymer non-conductive matte white reflector may be used to meet local codes for 'dead front' applications (500 & 750 lumen max. in IC and 3000 lumen max. in Non-IC)
- Wall wash reflector features a rotatable linear spread lens for alignment of vertical illumination
- Reflectors attach to LED module with three speed clamps
- Available in multiple painted or plated finishes

Reflector/Module Retention
- Reflector/module assembly is securely retained in the housing with two torsion springs

Driver
- Field-replaceable constant current driver provides low noise operation
- Universal 120-277VAC 50/60Hz input standard
- Continuous, 1% to 100% dimming with 0-10V analog control
- Optional low-voltage DC driver for use with Distributed Low Voltage Power (DLVP) system
- Distributed Low Voltage Power (DLVP) system combines power, lighting and controls with ease of installation (refer to DLVP Design Guide at www.cooperlighting.com for details)

Canada Options
- 347VAC 50/60Hz; 1% dimming on 0 -10V analog control, for 500, 750, 1000, 1500, 2000, 2500, 3000, 3500, 4000, 4500, 5000 lumen models only
- 347V step down transformer factory installed with the standard "D010" 120V-277V, LED driver on 5500, 6000 lumen models only

Emergency Option
- Provides 90 minutes of standby lighting, meeting most life safety codes for egress lighting
- Available with integral or remote charge indicator and test switch
- Available Self-Test (self-diagnostic) with remote charge indicator and test switch
- Quick Spec emergency ordering option for quick-turn projects

Connected Lighting System
Two WaveLinx connected solutions to choose from. Refer to WaveLinx system specifications and application guides for details.

WaveLinx PRO Tilemount Sensor Kit
- WaveLinx PRO WTA tilemount sensor kit offers daylight dimming, PIR motion sensing, scene and zone configuration, automatic commissioning; and optional RLTS - Real Time Location Services available.

WaveLinx PRO Wireless Node
- WaveLinx PRO WPN wireless node provides luminaire-level control with scene and zone configuration without an integrated sensor; Connects wirelessly with daylight dimming sensor and PIR motion sensor if desired. Use with 0-10V driver only. **Note:** Not compatible with 347V or Chicago plenum.

WaveLinx LITE Tilemount Sensor Kit
- WaveLinx LITE WTK tilemount sensor kit offers daylight dimming and PIR motion sensing, scene and grouping configuration.

WaveLinx LITE Wireless Node
- WaveLinx LITE WLN wireless node provides luminaire level control with scene and zone configuration without an integrated sensor; Connects wirelessly with daylight dimming sensor and PIR motion sensor if desired. Use with 0-10V driver only. **Note:** Not compatible with 347V or Chicago plenum.

WaveLinx Tilemount Sensor Kits Application
- The WTA and WTK tilemount sensor kits include a control module mounted on the luminaire junction box via 1/2" knock-out, and a tilemount sensor on 54-inch whip; for ceiling installation by direct-mount spring clips or via mounting bracket in octagon ceiling boxes.
- The WTA and WTK tilemount sensor kits may be ordered as factory installed on the luminaire, or ordered separately as a field installed accessory kit.
- **Note: WaveLinx PRO devices are only compatible with the WaveLinx PRO system.**
- **Note: WaveLinx LITE devices are only compatible with the WaveLinx LITE system.**

Junction Box
- Galvanized steel junction box
- 20 in^3 internal volume excluding voltage barrier
- 25 in^3 internal total volume
- Voltage barrier for 0-10V dimming wires (occupies one 1/2" pry-out space)
- Listed for eight #12 AWG (four in, four out) 90˚C conductors and feed-thru branch wiring
- Three 1/2" and two 3/4" trade size pry-outs available
- Three 4-port push wire nuts for mains voltage with 1-port for fixture connection

Compliance
- cULus Certified to UL 1598 / C22.2 No. 250.0, suitable for damp locations and wet locations in covered ceilings only
- Emergency options provided with UL Listed emergency drivers to UL 924 / C22.2 No. 141, suitable for indoor/damp locations
- IP20 - Above finished ceiling; IP64 - Below finished ceiling
- Non-Insulated ceiling (Non-IC) rated for 2000, 2500, 3000, 3500, 4000, 4500, 5000, 5500, 6000 lumen models (insulation must be kept 3" from top and sides)
- Insulated ceiling (IC) rated for 500, 750, 1000, 1500 lumen models and suitable for direct contact with air permeable insulation* (IC models are also suitable for Non-IC installations)
- Non-IC marked spacing required for 4500, 5000, 5500, 6000 lumen models
  - Marked Spacing Center to Center of Adjacent Luminaires = 36"
  - Center of Luminaire to Building Member = 18"
  - Minimum overhead = 0.5"
- Airtight per ASTM-E283-04
- Suitable for use in clothes closets when installed in accordance with the NEC 410.16 spacing requirements
- EMI/RFI emissions FCC CFR Title 47 Part 15 Class A at 120/277V
- Contains no mercury or lead and RoHS compliant
- Photometric testing completed in accordance of IES LM-79-08
- Lumen maintenance projection in accordance of IES LM-80-08 and TM-21-11
- 1,000 and 1,500 lumen, 90 CRI, ICAT models may be used to comply with State of California Title 24 residential code, per JA8 certification standards
- May be used to comply with State of California Title 24 non-residential code as a dimmable LED luminaire
- ENERGY STAR® certified, reference certified light fixtures database

*Not for use in direct contact with spray foam insulation, consult NEMA LSD57-2013

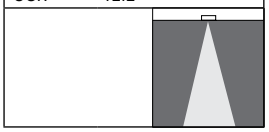
Warranty
- Five year limited warranty, consult website for details. www.cooperlighting.com/legal

Photometric Data

View IES files

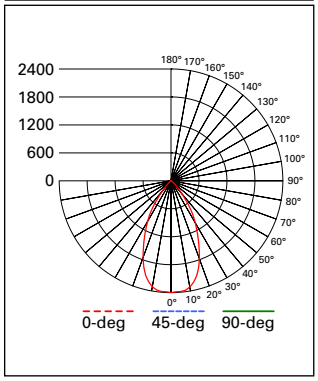
NARROW DISTRIBUTION - SPECULAR CLEAR FINISH, 2000 LUMEN MODEL, 80 CRI, 3500K

NARROW (50° BEAM*)	
Test Number	P571728
Housing	HC420D010
Module	HM40525835
Reflector	41NDC
Lumens	2010 Lm
Efficacy	100.5 Lm/W
SC	0.84
UGR	12.2

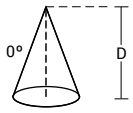


CANDLEPOWER DISTRIBUTION

Downlight



CONE OF LIGHT



MH	FC	L	W
5.5'	79.3	4.6	4.6
7'	49	5.8	5.8
8'	37.5	6.6	6.6
9'	29.6	7.4	7.4
10'	24	8.4	8.4
12'	16.7	10	10

CANDELA TABLE

Degrees Vertical	Candela
0	2400
5	2387
15	2110
25	1368
35	676
45	152
55	23
65	5
75	1
85	0
90	0

ZONAL LUMEN SUMMARY

Zone	Lumens	% Fixture
0-30	1436	71.5
0-40	1848	92
0-60	2002	99.6
0-90	2010	100
90-180	0	0
0-180	2010	100

LUMINANCE

Average Candela Degrees	Average 0° Luminance
45	26514
55	4968
65	1576
75	667
85	0

*Value are nominal for specular clear reflectors, other may vary.
SC = Spacing Criteria
UGR = Unified Glare Rating

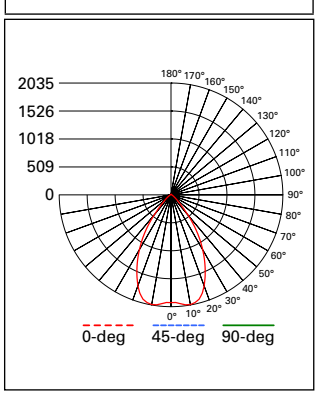
MEDIUM DISTRIBUTION - SPECULAR CLEAR FINISH, 2000 LUMEN MODEL, 80 CRI, 3500K

MEDIUM (60° BEAM*)	
Test Number	P571727
Housing	HC420D010
Module	HM40525835
Reflector	41MDC
Lumens	2096 Lm
Efficacy	104.8 Lm/W
SC	1.0
UGR	13.6

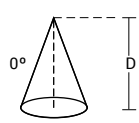


CANDLEPOWER DISTRIBUTION

Downlight



CONE OF LIGHT



MH	FC	L	W
5.5'	65.3	5.4	5.4
7'	40.3	6.8	6.8
8'	30.9	7.8	7.8
9'	24.4	8.8	8.8
10'	19.8	9.8	9.8
12'	13.7	11.8	11.8

CANDELA TABLE

Degrees Vertical	Candela
0	1969
5	1997
15	1974
25	1467
35	800
45	192
55	26
65	4
75	1
85	0
90	0

ZONAL LUMEN SUMMARY

Zone	Lumens	% Fixture
0-30	1408	67.1
0-40	1899	90.6
0-60	2091	99.7
0-90	2096	100
90-180	0	0
0-180	2096	100

LUMINANCE

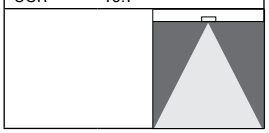
Average Candela Degrees	Average 0° Luminance
45	33405
55	5548
65	1197
75	667
85	0

*Value are nominal for specular clear reflectors, other may vary.
SC = Spacing Criteria
UGR = Unified Glare Rating

Note: Refer to IES files for more product data.

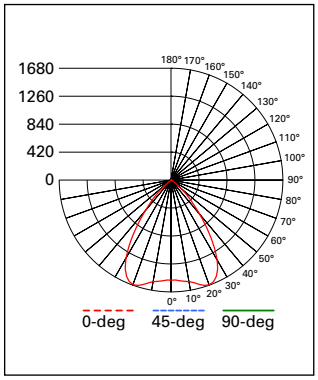
WIDE DISTRIBUTION - SPECULAR CLEAR FINISH, 2000 LUMEN MODEL, 80 CRI, 3500K

WIDE (75° BEAM*)	
Test Number	P571730
Housing	HC420D010
Module	HM40525835
Reflector	41WDC
Lumens	2304 Lm
Efficacy	115.2 Lm/W
SC	1.25
UGR	15.7

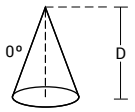


CANDLEPOWER DISTRIBUTION

Downlight



CONE OF LIGHT



MH	FC	L	W
5.5'	49.9	6.8	6.8
7'	30.8	8.6	8.6
8'	23.6	9.8	9.8
9'	18.6	11.2	11.2
10'	15.1	12.4	12.4
12'	10.5	14.8	14.8

CANDELA TABLE

Degrees Vertical	Candela
0	1509
5	1525
15	1630
25	1603
35	1012
45	369
55	44
65	5
75	1
85	0
90	0

ZONAL LUMEN SUMMARY

Zone	Lumens	% Fixture
0-30	1334	57.9
0-40	1960	85.1
0-60	2296	99.7
0-90	2304	100
90-180	0	0
0-180	2304	100

LUMINANCE

Average Candela Degrees	Average 0° Luminance
45	64437
55	9355
65	1576
75	667
85	0

*Value are nominal for specular clear reflectors, other may vary.
SC = Spacing Criteria
UGR = Unified Glare Rating

Photometric Multipliers (Nominal Lumen Values)

500 Lumen	750 Lumen	1000 Lumen	1500 Lumen	2000 Lumen	2500 Lumen	3000 Lumen	3500 Lumen
0.33	0.44	0.54	0.74	1.00	1.24	1.54	1.85

4000 Lumen	4500 Lumen	5000 Lumen	5500 Lumen	6000 Lumen
2.15	2.28	2.44	2.52	2.62

Multipliers for relative lumen values with other series models.

Color Finish Multipliers

Finish code	C	H	W/WB	BB
Finish	Specular Clear	Semi-Specular	Matte White White Baffle	Black Baffle
Multiplier	1.00	0.94	0.88	0.76

Multipliers for relative lumen values with other color finishes.

CCT Multipliers – 80CRI

2700K	3000K	3500K	4000K	5000K
0.89	0.96	1.00	1.03	1.03

Multipliers for relative lumen values with other series color temperatures.

CCT Multipliers – 90CRI

2700K	3000K	3500K	4000K	5000K
0.76	0.85	0.89	0.93	0.93

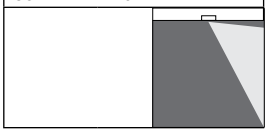
Multipliers for relative lumen values with other series color temperatures.

Note: Refer to IES files for more product data.

WALL WASH DISTRIBUTION - SPECULAR CLEAR FINISH, 2000 LUMEN MODEL, 80 CRI, 3500K

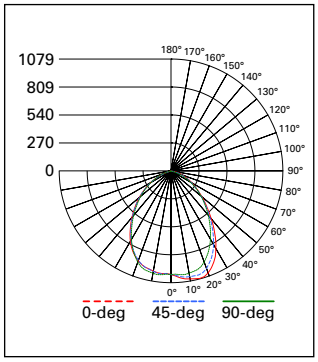
WALL WASH

Test Number	P571729
Housing	HC420D010
Module	HM40525835
Reflector	41RWWC
Lumens	2094 Lm
Efficacy	104.7 Lm/W
SC	1.15



CANDLEPOWER DISTRIBUTION

Downlight



CANDELA TABLE

Degrees Vertical	Candela
0	1005
5	1041
15	1079
25	980
35	743
45	494
55	312
65	180
75	80
85	10
90	0

ZONAL LUMEN SUMMARY

Zone	Lumens	% Fixture
0-30	789	37.7
0-40	1221	58.3
0-60	1872	89.4
0-90	2094	100
90-180	0	0
0-180	2094	100

LUMINANCE

Average Candela Degrees	Average 0° Luminance
45	86207
55	67159
65	52681
75	38173
85	13445

SC = Spacing Criteria, nominal for specular clear reflector, other may vary.

SINGLE UNIT FOOTCANDLES

	2.5' from wall (distance from fixture along wall)						
1	18.7	13.6	6.1	2.3	0.8	0.3	0.1
2	28.4	22.3	12.2	5.7	2.6	1.2	0.6
3	25.9	21.4	13.3	7.2	3.8	2	1.1
4	19.6	16.9	11.6	7	4.1	2.4	1.4
5	13.6	12.3	9.2	6.2	3.9	2.5	1.5
6	9.3	8.6	7	5.1	3.5	2.3	1.6
7	6.4	6.1	5.2	4.1	3	2.1	1.5
8	4.6	4.4	3.9	3.2	2.5	1.8	1.3
9	3.3	3.2	2.9	2.5	2	1.6	1.2
10	2.5	2.4	2.2	2	1.7	1.4	1.1

MULTIPLE UNIT FOOTCANDLES

	2.5' from wall (Distance from fixture along wall) 3			2.5' from wall (Distance from fixture along wall) 4		
1	21	18.8	21	19.5	12.1	19.5
2	34.1	34.1	34.1	31	24.4	31
3	33.1	34.4	33.1	29.7	26.5	29.7
4	26.7	28.7	26.7	23.7	23.3	23.7
5	19.8	21.7	19.8	17.5	18.5	17.5
6	14.4	15.8	14.4	12.8	14	12.8
7	10.5	11.4	10.5	9.4	10.4	9.4
8	7.8	8.3	7.8	7	7.7	7
9	5.8	6.2	5.8	5.4	5.9	5.4
10	4.4	4.7	4.4	4.1	4.5	4.1

Photometric Multipliers (Nominal Lumen Values)

500 Lumen	750 Lumen	1000 Lumen	1500 Lumen	2000 Lumen	2500 Lumen	3000 Lumen	3500 Lumen
0.33	0.44	0.54	0.74	1.00	1.24	1.54	1.85

4000 Lumen	4500 Lumen	5000 Lumen	5500 Lumen	6000 Lumen
2.15	2.28	2.44	2.52	2.62

Multipliers for relative lumen values with other series models.

Color Finish Multipliers

Finish code	C	H	W/WB	BB
Finish	Specular Clear	Semi-Specular	Matte White White Baffle	Black Baffle
Multiplier	1.00	0.94	0.88	0.76

Multipliers for relative lumen values with other color finishes.

CCT Multipliers – 80CRI

2700K	3000K	3500K	4000K	5000K
0.89	0.96	1.00	1.03	1.03

Multipliers for relative lumen values with other series color temperatures.

CCT Multipliers – 90CRI

2700K	3000K	3500K	4000K	5000K
0.76	0.85	0.89	0.93	0.93

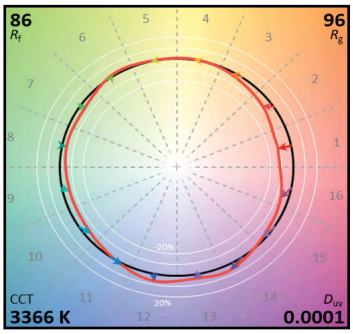
Multipliers for relative lumen values with other series color temperatures.

Note: Refer to IES files for more product data.

Energy & Performance Data

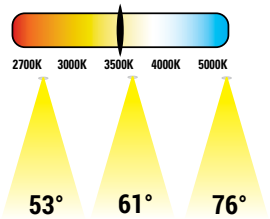
COLOR METRICS - TM-30-15 & CRI/CIE (3500K)

80 CRI Color Metric Summary - 3500K*

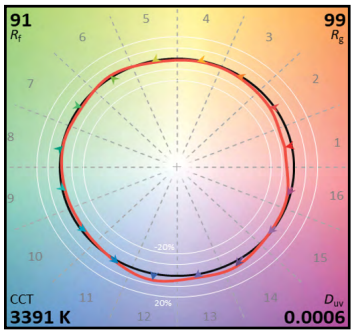


Reference Illuminant — Test Source

TM-30-15	Rf = 86
	Rg = 95.5
CRI/CIE	Ra = 83.8
	R9 = 10.3

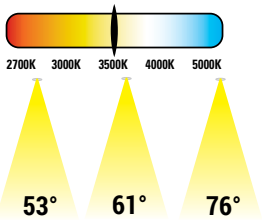


90 CRI Color Metric Summary - 3500K*



Reference Illuminant — Test Source

TM-30-15	Rf = 91.1
	Rg = 99
CRI/CIE	Ra = 92.4
	R9 = 55.1



* Color values are based on 61WDWB reflector, other finishes and field results may vary.

ENERGY DATA

Series	500 lumen		750 lumen		1000 lumen		1500 lumen		2000 lumen	
Input Voltage 120-277VAC	120V	277V	120V	277V	120V	277V	120V	277V	120V	277V
Input Current (A)	0.051	0.026	0.067	0.036	0.083	0.039	0.119	0.053	0.171	0.077
Input Power (W)	6.1	6.5	7.9	8.3	10	10.4	14.5	14.5	20.9	20.6
In-rush (A)	1.9	8.4	2	8.4	2.2	8.5	2.7	8.5	2.1	9.7
Inrush duration (µs)	251	135	237	133	250	134	250	139	245	131
THD (%)	6.2	13.5	7.4	8.8	5.4	10.3	10	6.7	6.5	7.9
PF	≥ 0.99	≥ 0.9	≥ 0.98	≥ 0.92	≥ 0.99	≥ 0.95	≥ 0.99	≥ 0.97	≥ 0.99	≥ 0.96

Series	2500 lumen		3000 lumen		3500 lumen		4000 lumen		4500 lumen	
Input Voltage 120-277VAC	120V	277V	120V	277V	120V	277V	120V	277V	120V	277V
Input Current (A)	0.23	0.103	0.24	0.107	0.292	0.152	0.351	0.159	0.384	0.172
Input Power (W)	27.5	27.5	28.6	28.5	34.6	35.1	42.1	42.1	45.9	45.6
In-rush (A)	2.5	5.6	2.5	11.6	3.4	13.9	3.1	14.7	3.1	14.8
Inrush duration (µs)	232	123	216	111	183	95	200	98	202	100
THD (%)	6.5	8.1	7.8	8.3	5.6	10	4.1	9.5	4.5	8.5
PF	≥ 0.99	≥ 0.96	≥ 0.99	≥ 0.96	≥ 0.99	≥ 0.93	≥ 0.99	≥ 0.94	≥ 0.99	≥ 0.95

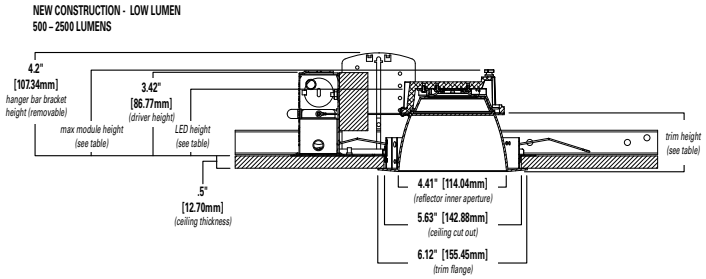
Series	5000 lumen		5500 lumen		6000 lumen	
Input Voltage 120-277VAC	120V	277V	120V	277V	120V	277V
Input Current (A)	0.419	0.186	0.457	0.201	0.489	0.214
Input Power (W)	50.1	49.5	54.6	53.7	58.4	57.4
In-rush (A)	3.1	15	3.2	14.8	3.4	14.8
Inrush duration (µs)	202	117	196	131	192	121
THD (%)	5.5	7.6	7	7.2	8.1	7.2
PF	≥ 0.99	≥ 0.96	≥ 0.99	≥ 0.96	≥ 0.99	≥ 0.97

Minimum starting temperature -30°C (-22°F)* (Nominal input 120-277VAC & 100% of rated output power)
Sound Rating: Class A standards

Notes:
* Emergency Battery packs are rated for a minimum starting temperature of 0°C.

Dimensional and Mounting Details

NEW CONSTRUCTIONS - LOW LUMEN 500 – 2500 LUMENS



Low Lumen (500 – 2500 Lumens)*

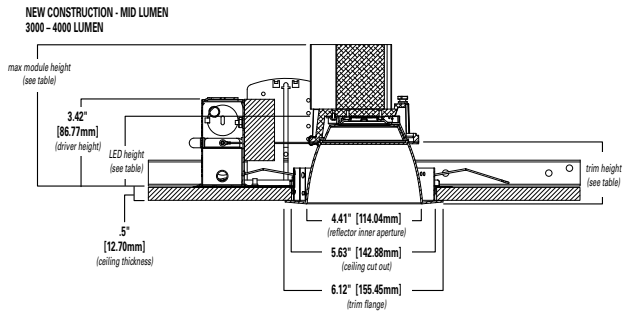
Distribution	Max. Module Height	Trim Height	LED Height
Narrow	3.6"	2.5"	2.7"
Medium	3.7"	2.6"	2.8"
Wide	3.5"	2.4"	2.6"
Baffle	3.1"	2.4"	2.6"

*Max. height w/removable hanger bar bracket 4.2"



Low Lumen Module

NEW CONSTRUCTIONS - MID LUMEN 3000 – 4000 LUMENS



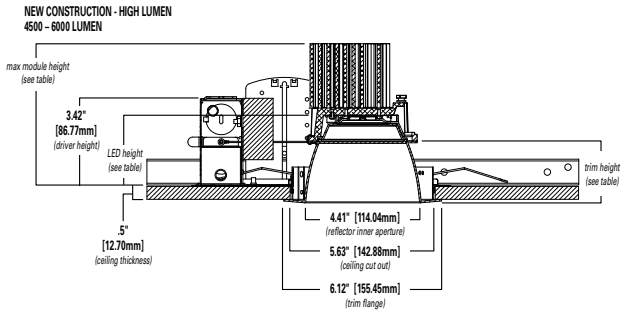
Mid Lumen (3000 – 4000 Lumens)

Distribution	Max. Module Height	Trim Height	LED Height
Narrow	5.6"	2.5"	2.9"
Medium	5.7"	2.6"	3.0"
Wide	5.5"	2.4"	2.8"
Baffle	5.5"	2.4"	2.8"



Mid Lumen Module

NEW CONSTRUCTIONS - HIGH LUMEN 4500 – 6000 LUMENS



High Lumen (4500 – 6000 Lumens)

Distribution	Max. Module Height	Trim Height	LED Height
Narrow	5.9"	2.5"	2.9"
Medium	6.0"	2.6"	3.0"
Wide	5.8"	2.4"	2.8"
Baffle	5.8"	2.4"	2.8"



High Lumen Module

Connected Solutions



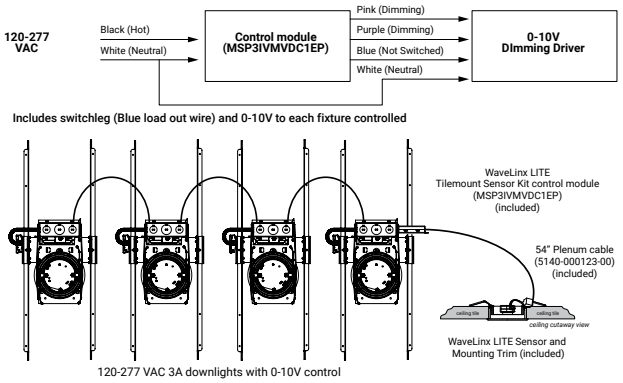
WaveLinx LITE - WTK Tilemount Sensor

WaveLinx LITE devices only compatible with the WaveLinx LITE system.

- Intuitive Android™ or Apple® iOS® app for basic system code compliant set up and configuration via Bluetooth
- Up to 28 unique areas per project site (WaveLinx LITE Bluetooth network)
- Up to 50 devices for an area, any one of 16 control zones, up to 6 occupancy sets, and custom lighting scenes
- Automatic occupancy or vacancy, sensor sensitivity, daylight dimming, etc. configurable through the app
- Refer to the WaveLinx system specifications for details

Device Security | Manual Dimmer | Occupancy Sensor | Daylighting Control | Manually Switched ON/OFF | Tuning Control | Lumen Maintenance Control | Scenes

WaveLinx LITE WTK Tilemount Wiring Diagram



WaveLinx LITE Bluetooth Enabled System



WaveLinx PRO – WTA Tilemount Sensor

WaveLinx PRO devices only compatible with the WaveLinx PRO system.



- WaveLinx PRO tilemount functionality configures zones and customizes settings from one secure mobile app
- Automatic code commissioning that meets the strictest codes
- Fixtures and sensors integrate with Wireless Area Controller, Wall Stations, and Control Devices
- Stand-Alone Offices or Entire Building Network Installations



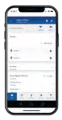
Downlights with tilemount sensor wireless communication
Highly efficient LED fixtures



WaveLinx Area Controller
Provides centralized coordination of multiple area control options



Wireless Wall Station/Receptacle
Provides customized wireless control of each area



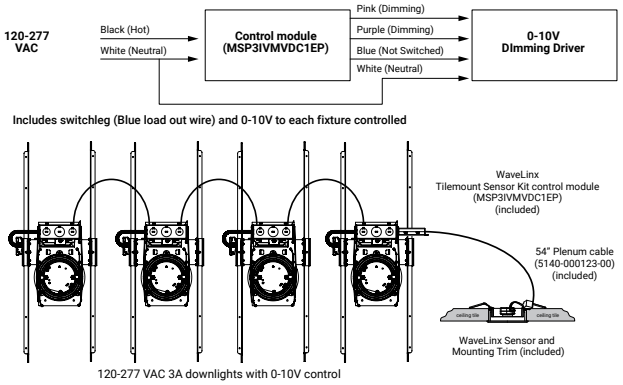
Mobile Applications
Provides personalized, local control from a tablet or smartphone

WaveLinx mobile app settings

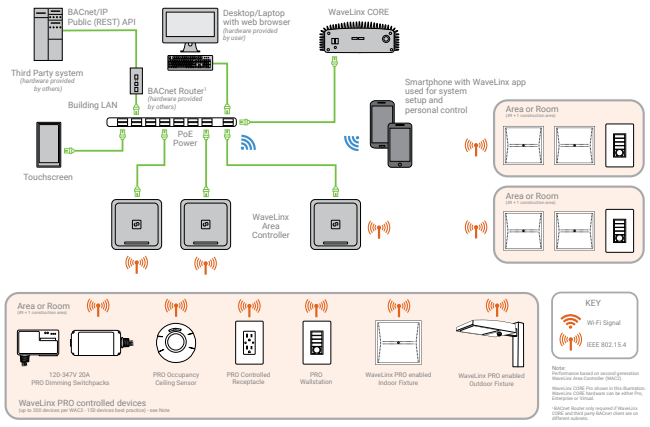
Manual Dimmer | Occupancy Sensor | Lumen Maintenance Control | Daylighting Control

Receptacle Control | Tuning Control | Scheduling | Manually Switched ON/OFF | Demand Response

WaveLinx WTA Tilemount Wiring Diagram



WaveLinx CORE Building Management Integration



Connected Solutions



WaveLinx LITE Wireless Node - WLN

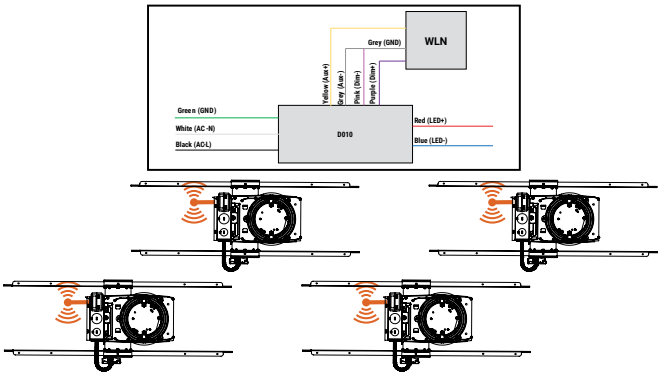
WaveLinx LITE devices only compatible with the WaveLinx LITE system.

- Intuitive Android™ or Apple® iOS® app for basic system code compliant set up and configuration via Bluetooth
- Up to 28 unique areas per project site (WaveLinx LITE Bluetooth network)
- Up to 50 devices for an area, any one of 16 control zones, up to 6 occupancy sets, and custom lighting scenes
- Refer to the WaveLinx system specifications for details

WaveLinx mobile app settings

Device Security | Manual Dimmer | Occupancy Sensor | Daylighting Control | Manually Switched ON/OFF | Tuning Control | Lumen Maintenance Control | Scenes

WaveLinx LITE Wireless Node (WLN) Wiring Diagram



WaveLinx LITE Bluetooth Enabled System





WaveLinx PRO Wireless Node - WPN

WaveLinx PRO devices only compatible with the WaveLinx PRO system.

- WaveLinx Wireless functionality configures zones and customizes settings from one secure mobile app
- Automatic code commissioning that meets the strictest codes
- Fixtures and sensors integrate with WaveLinx Area Controller, Wall Stations, and Control Devices
- Stand-Alone Offices or Entire Building Network Installations



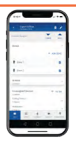
Downlights with wireless communication
Highly efficient LED fixtures



WaveLinx Area Controller
Provides centralized coordination of multiple area control options



Wireless Wall Station/Receptacle
Provides customized wireless control of each area

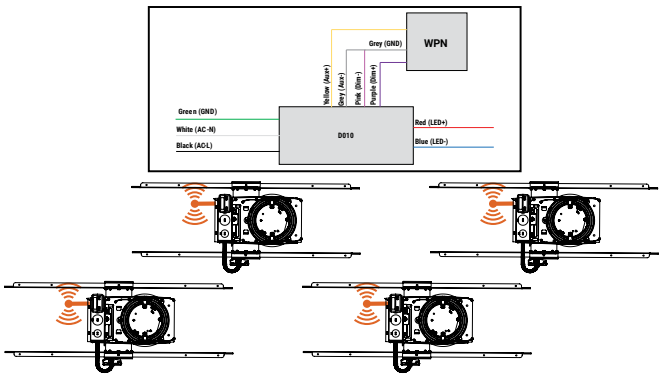


Mobile Applications
Provides personalized, local control from a tablet or smartphone

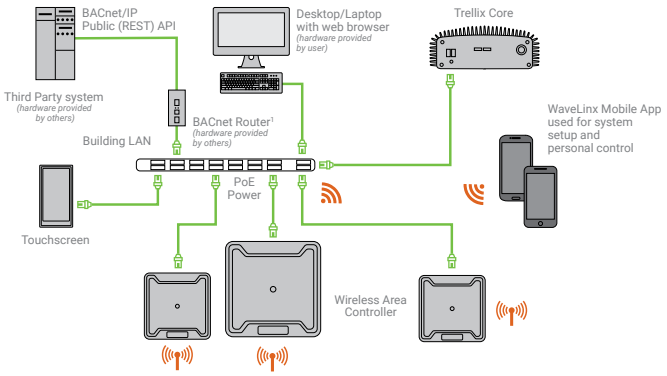
WaveLinx mobile app settings

Manual Dimmer | Occupancy Sensor | Lumen Maintenance Control | Daylighting Control | Receptacle Control | Tuning Control | Scheduling | Manually Switched ON/OFF | Demand Response

WaveLinx PRO Wireless Node (WPN) Wiring Diagram



WaveLinx CORE Building Management Integration



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Specifications and dimensions subject to change without notice.

LOW BAY

architectural

Project:

Type:

Catalog number:

L7
L7B
L7C

LED 16"

VR series, 7000 to 12000 lumens

LED low bay | 120-277 Volt

This fixture features a 5/8" OD mounting stem with a 5" diameter swivel canopy that self-adjusts up to 45° to accommodate sloped ceilings. Factory standard pendant length is 12". Pendants are available in lengths listed in the options section. 48" is the longest continual length. Longer lengths are available in 12 inch increments and will be joined with a coupling. For custom lengths, specify the FC Field Cut kit and a standard length that can be cut to desired length in the field.

Housing has a polyester powder coat finish offered in white, black, metallic silver and custom colors.

5-year LED component warranty details at atlantic-lighting.com/main/support.

Bridgelux Vero 29 Array Series

- Rated Life: 50,000 hours at 70% lumen maintenance (L70) when maintained in a 35°C ambient environment with open air flow. Ambient temperatures lower than 35°C may extend life of module.
- 80 CRI is standard and a 90 CRI option is offered. With the 90 CRI option, lower lumen output and reduced lumens per watt will be experienced.

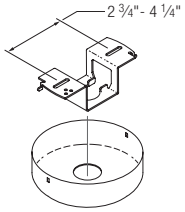
Electronic Driver

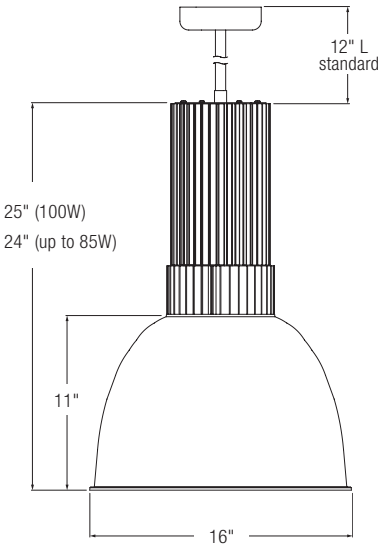
- 0-10V dimming to 10% (Dimming not offered with coil cord options)

Listed to UL 1598 and Canadian standards for Damp Location. Intended for indoor applications only. Photometrics at atlantic-lighting.com.

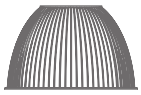
Specifications and dimensions subject to change without notice.

PROUDLY ASSEMBLED IN AMERICA



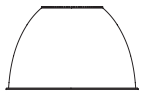


DOME



open refractor

L16PRA	Prismatic dome, acrylic
L16PRA-DIF	Diffused prismatic dome, acrylic. 80/20 distribution
L16PRP	Prismatic dome, polycarbonate



aluminum shade

L16ALWH	White dome
L16ALBL	Black dome
L16ALMS	Metallic silver dome
L16ALCC	Custom color dome

Note: Interior surface of the aluminum shade is high reflective white, standard. Exterior is textured finish.



*Listed lumens and wattages are component measurements. See photometrics for fixture values.

ordering data

SERIES LHB16

LHB16	Low bay 16"

WATTS

VR55	55 watts (≈ 7000 lumen)
VR70	70 watts (≈ 9000 lumen)
VR85	85 watts (≈ 10,500 lumen)
VR100	100 watts (≈ 12000 lumen)

COLOR TEMPERATURE See schedule

27K	2700K
3K	3000K
35K	3500K
4K	4000K
5K	5000K

DIMMING

0-10V DC standard, leave box blank

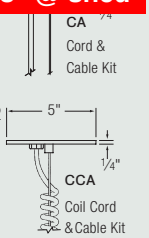
HOUSING

WH	White
BL	Black
MS	Metallic silver
CC	Custom color (consult factory)

OPTIONS

P18	18" pendant length
P24	24" pendant length
P36	36" pendant length
P48	48" pendant length
CA	Cord and cable, 6 ft.
CAxx	Cord and cable, custom length replace xx with length in feet
CCA	Coil cord and cable, adjustable from 2 to 8 feet in length
CCA12	Coil cord and cable, from 4 to 12 feet in length
9CR	90 CRI, effects lumens per watt
RLEM	Remote Emergency Pack. Contact factory for details. Not available on cord mount

30" @ head
48" @ shed

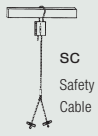


DOME

◂◂◂ Refer to left for shade options.

ACCESSORIES

WG16	Wire guard, bottom
FCL16	Flat clear lens, acrylic
SC	Safety cable, 6 ft. standard
347V	347V Step down transformer for remote installation
FC	Field cut kit
OR16x	Decorative outrigger kit (see spec sheet NP20-002)



P/N Example: LHB16-VR55-27K-WH-P18/L16PRA/PLA16

LHB16-VR55-27K-WH-P18/L16PRA/PLA16

series | lumens | temp | housing | options | dome | accessories

ATLANTIC LIGHTING

LOW BAY

architectural

Project:

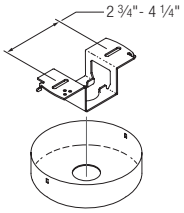
Type:

Catalog number:

L7A

LED 12"

VR series, 1500 to 4000 lumens



LED low bay | 120-277 Volt

This fixture features a 5/8" OD mounting stem with a 5" diameter swivel canopy that self-adjusts up to 45° to accommodate sloped ceilings. Factory standard pendant length is 12". Pendants are available in lengths listed in the options section. 48" is the longest continual length. Longer lengths are available in 12 inch increments and will be joined with a coupling. For custom lengths, specify the FC Field Cut kit and a standard length that can be cut to desired length in the field.

Housing has a polyester powder coat finish offered in white, black, metallic silver and custom colors.

5-year LED component warranty details at atlantic-lighting.com/main/support.

Bridgelux Vero 18 Array Series

- Rated Life: 50,000 hours at 70% lumen maintenance (L70) when maintained in a 35°C ambient environment with open air flow. Ambient temperatures lower than 35°C may extend life of module.
- 80 CRI is standard and a 90 CRI option is offered. With the 90 CRI option, lower lumen output and reduced lumens per watt will be experienced.

Electronic Driver

- 0-10V dimming to 1% (Dimming not offered with coil cord options)
- 50/60 Hz
- 120V-277V

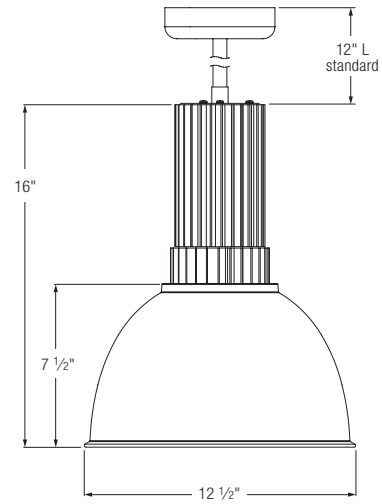
Heat Sink

- Black anodized aluminum passive heat sink, designed for maximum heat dissipation.

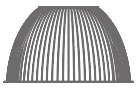
Listed to UL 1598 and Canadian standards for Damp Location. Intended for indoor applications only. Photometrics at atlantic-lighting.com.

Specifications and dimensions subject to change without notice.

PROUDLY ASSEMBLED IN AMERICA

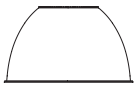


DOME



open refractor

12PRA	Prismatic dome, acrylic
12PRA-DIF	Diffused prismatic dome, acrylic. 60/40 distribution
12PRP	Prismatic dome, polycarbonate



aluminum shade

12ALWH	White dome
12ALBL	Black dome
12ALMS	Metallic silver dome
12ALCC	Custom color dome

Note: Interior surface of the aluminum shade is high reflective white, standard. Exterior is textured finish.



*Listed lumens and wattages are component measurements. See photometrics for fixture values.

ordering data

SERIES LHB12

LHB12	Low bay 12"

WATTS

VR15	15 watts (≈ 1500 lumen)
VR20	20 watts (≈ 2000 lumen)
VR25	25 watts (≈ 3000 lumen)
VR35	35 watts (≈ 4000 lumen)

COLOR TEMPERATURE

27K	2700K
3K	3000K
35K	3500K
4K	4000K
5K	5000K

DIMMING

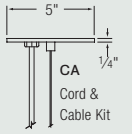
	0-10V DC standard, leave box blank
2WR	2-wire. TRIAC forward-phase or ELV reverse-phase (100%-1%) (120V only)
DAL	DALI (Type 6, IEC62386) Driver; Dimming to 0.1%
DMX	DMX Driver with RDM capability; Dimming to 0.1% (not available on cord mount)
347V	347V 0-10V 1% Dimming Driver

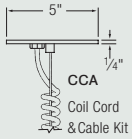
HOUSING

WH	White
BL	Black
MS	Metallic silver
CC	Custom color (consult factory)

OPTIONS

P18	18" pendant length
P24	24" pendant length
P36	36" pendant length
P48	48" pendant length
CA	Cord and cable, 6 ft.
CAxx	Cord and cable, custom length replace xx with length in feet
CCA	Coil cord and cable, adjustable from 2 to 8 feet in length
CCA12	Coil cord and cable, from 4 to 12 feet in length
9CR	90 CRI, effects lumens per watt
RLEM	Remote Emergency Pack. Contact factory for details. Not available on cord mount



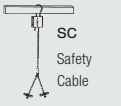


DOME

◂◂◂ Refer to left for shade options.

ACCESSORIES

PLA12	Conical prismatic lens, Acrylic
PLP12	Conical prismatic lens, Polycarb.
FCL12	Flat clear lens, acrylic
SC	Safety cable, 6 ft. standard
FC	Field cut kit



P/N Example: LHB12-VR35-27K-WH-P18/12PRA/PLA12

LHB12 - VR35 - 27K - WH - P18 / 12PRA / PLA12

series | lumens | temp | housing | options | dome | accessories

L8A
L8B
L8C

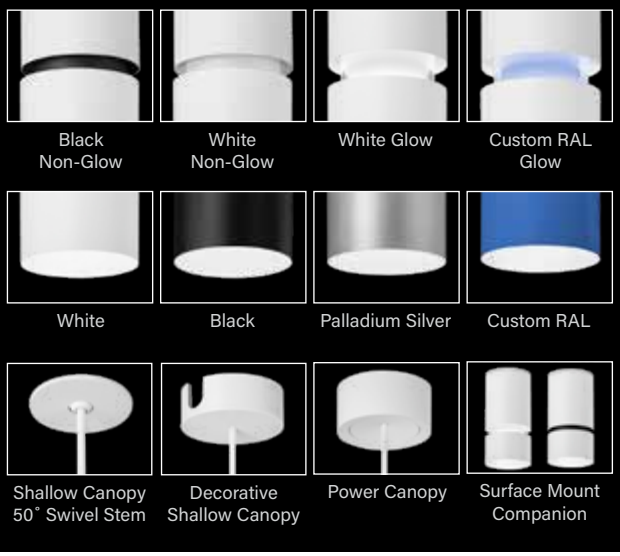
ID+ 4.5" Cylinder

LED PENDANT WITH DECORATIVE REVEAL

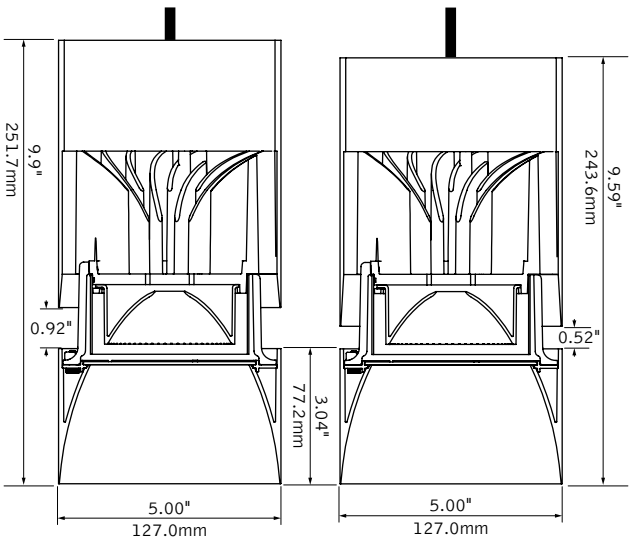
FOCAL POINT®



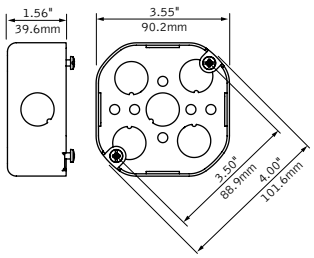
The Naturals collection - White/Chestnut shown

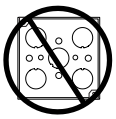


DIMENSIONAL DATA (continued on page 3 & 4)



4" Octogonal J-Box required
(By others)





Not Compatible with 4" Square J-Box

FEATURES

4.5" cylinder pendant with decorative reveal; glow or non-glow options.

One-piece die-cast reflector with a knife edge for a modern aesthetic.

50° cut-off for brightness control and visual comfort.

Multiple canopy options enable various driver offerings and conduit installations while maintaining premier aesthetics.

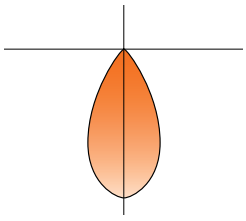
Power cord, fixed and swivel stem suspension mounting options.

Available with The Naturals, a series of finishes that exude biophilic beauty.

Warm Dim: Lighting that enhances spaces with a warm glow, reminiscent of incandescent or halogen light sources.

PoE compatible: Integrates with Power over Ethernet lighting systems via standard, low-voltage wires.

PERFORMANCE

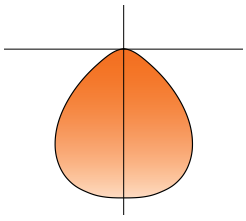


18˚ Spot

Lumen Output: 1500lm

Total System Watts: 18W

Spacing Criterion: 0.33



98˚ Super Wide Flood

Lumen Output: 1500lm

Total System Watts: 18W

Spacing Criterion: 1.34

Photometric performance is measured in accordance with IESNA LM-79.
Visit focalpointlights.com for complete photometric data.

fixture: project:

SPECIFICATIONS

LED System

Proprietary LED module with single light emitting source. May be specified in 2700K, 3000K, 3500K or 4000K in CRI>80 or CRI>90. 3500K and 4000K with CRI>90 have a cyanosis observation index (COI) of 3.3 or less. Color accuracy within 2 SDCM. Aluminum heat sink provides appropriate thermal management.

Construction

Upper housing is extruded aluminum. Lower reflector is die-cast aluminum. Twist & lock construction leaves no visible fasteners within the knife edge trim. Fixture will not exceed 5 lb.

Optics

Beam spreads achieved with optics that may be easily changed in field.

Lumen Output	Cut-Off Degree	Distribution Beam Spread | Spacing Criteria					
		SP	NFL	FL	WFL	VWFL	SWFL
1000 - 1500	50˚	18˚ | 0.33	27˚ | 0.48	35˚ | 0.59	54˚ | 0.83	69˚ | 1.02	—
	80˚	—	—	—	—	—	98˚ | 1.34
2000 - 3000	50˚	—	26˚ | 0.44	41˚ | 0.67	56˚ | 0.83	69˚ | 1.08	—
	80˚	—	—	—	—	—	98˚ | 1.34

Electrical

Choice of constant current dimming drivers. Power factor > .9 typical. PoE compatible: Integrates with Power over Ethernet lighting systems via standard, low-voltage wires.
L11 & LFP with Shallow Canopy, Integral Driver not Right Light as standard, consult factory.

Emergency

Emergency output — 7W for 90 minutes. Maximum mounting height: 16ft.
J-box cannot be recessed above the ceiling with Emergency Battery.

Labels

UL and cUL listed. Suitable for Dry or Damp Locations, indoor use only.

Finish

Polyester powder coat applied over a multi-stage pre-treatment. The Naturals: 100% low VOC vinyl.

Lumen Maintenance

Reported: L70 > 60,000 hours
L80 > 60,000 hours

Calculated: L70 at > 204,000 hours
L80 at > 126,000 hours

(Derived from EPA TM-21 calculator. Based on typical conditions, consult factory for additional data.)

Reliability

At Focal Point, our products are designed to stand the test of time. Each luminaire is engineered using superior components, manufactured with the utmost care and rigorously tested. Contact us for reliability data.

Warranty

LED system rated for operation in ambient environments up to 25°C. 5 year limited warranty.

PERFORMANCE TABLE

	Lumen Output	Delivered Lumens	System Watts	LPW
	1000L	1033	11	91
	1500L	1509	18	86
WD	1500L	1606	23	69
	2000L	2074	24	88
	2500L	2609	31	84
WD	2500L	2211	35	63
	3000L	2906	34	84

Glowing Reveal, 3500K, 80CRI, Clear Diffuse, Flood distribution.Warm Dim based on 3000 - 1800K, 90 CRI.
Lumen output may vary +/- 5%. Actual wattage may vary +/- 5%.

QS **10 DAY** Options in orange qualify for the Quickship program. 10-day up to 50 pieces. Refer to Quickship Guide for complete details.

Focal Point LLC reserves the right to change specifications for product improvement without notification.

ORDERING

L8A
L8B
L8C

Luminaire Series — FLCY
ID+ 4.5" Round Cylinder: FLCY4

Trim Type — RD
Round: RD

Decorative Reveal
White Non-Glow Reveal: WHR
Black Non-Glow Reveal: BKR
White Glowing Reveal: WHG
Custom Color Glowing Reveal[1]: RAL_ _ _

See schedule

Lumen Output
1000 Lumens: 1000L
1500 Lumens: 1500L
2000 Lumens: 2000L
2500 Lumens: 2500L
3000 Lumens (PC & DPC only.): 3000L

Color Temperature
2700K, 80+ CRI **or** 90+ CRI: 27K **or** 927K
3000K, 80+ CRI **or** 90+ CRI: 30K **or** 930K
3500K, 80+ CRI **or** 90+ CRI: 35K **or** 935K
4000K, 80+ CRI **or** 90+ CRI: 40K **or** 940K
Warm Dim: 2700-1800K, 90+ CRI: 92718W
Warm Dim: 3000-1800K, 90+ CRI: 93018W
(Warm Dim:1500L & 2500L only. EMR not available. 2500L PC & DPC only.)

Circuit — 1C
Single Circuit: 1C

Voltage
120/277 UNV: UNV
120 Volt: 120
277 Volt: 277
Low Voltage: LV

Canopy Configuration
(BK and WH finish by default, see finishes page for details. Optional Naturals finishes may be specified for Shallow Canopy (SC) and Power Canopy (PC) by adding the finish color to the canopy code. For example: Shallow Canopy in Light Oak = SCLOK.)
Shallow Canopy, Integral Driver*: SC
Shallow Canopy with decorative J-box cover, Integral Driver*: DSC
Power Canopy: PC
Power Canopy with decorative J-box cover: DPC

Control System & Dimming Level
0-10V - 0% Dimming: LZ1
0-10V - 1% Dimming: L11
Low Voltage, PoE compatible (No driver. Not available with EMR. SC or DSC with LV Voltage only.): LVN
Phase Dimming (SC with 120V only. Consult factory for recommended dimmers.): LFP
Lutron Hi-Lume EcoSystem (LDE1) - 1% Dimming: LH1
DALI - 0% Dimming: DZ1
DALI - 1% Dimming: D11

Mounting
72" Cable, Straight Feed (Cut in field): C72
144" Cable, Straight Feed (Cut in field): C144
12", 50˚ Swivel Stem: B12
18", 50˚ Swivel Stem: B18
2'– 8' in 1' increments, 50˚ Swivel Stem (Specify in inches, example: 8' stem = B96): B_
12", Fixed Stem: S12
18", Fixed Stem: S18
2'– 8' in 1' increments, Fixed Stem (Specify in inches, example: 8' stem = S96): S_

Optic
50˚ Cut-off Cone (Not available with SWFL): DNT
50˚ Cut-off Cone with Solite Lens (NFL only): DNTS
80˚ Cut-off Cone (SWFL only): DSS

Distribution
Spot (1000L & 1500L only): SP
Narrow Flood: NFL
Flood: FL
Wide Flood: WFL
Very Wide Flood: VWFL
Super Wide Flood: SWFL

Factory Options
Emergency Battery (J-box cannot be recessed above the ceiling. Remote test switch.): EMR

Reflector Color — CD
Clear Diffuse: CD

Luminaire Finish
Upper Housing Finish
Lower Housing Finish

Specify an upper and lower housing finish. See finishes page for The Naturals options and standard color combinations for cylinder, cord/stem, and canopy.

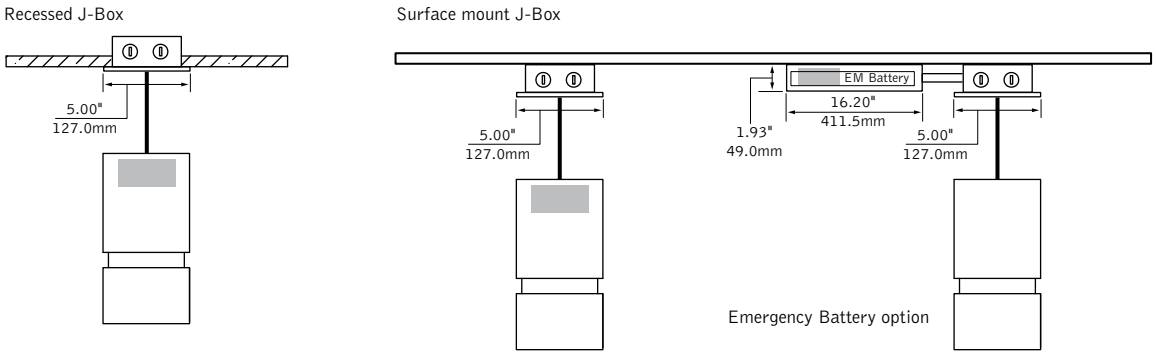
Black: BK
White: WH
Palladium Silver: PS
Custom Color[1]: RAL_ _ _ _

*(L11, LVN & LFP only. Warm Dim: 1500L only.)
[1](Specify your RAL code. Extended lead time. Consult factory.)

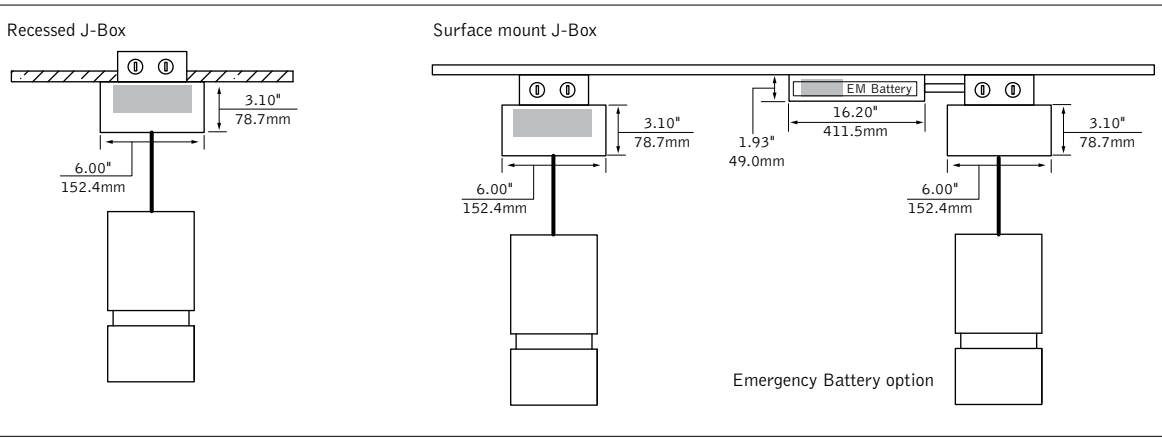
DIMENSIONAL DATA CONTINUED

SC - Shallow Canopy, Integral Driver

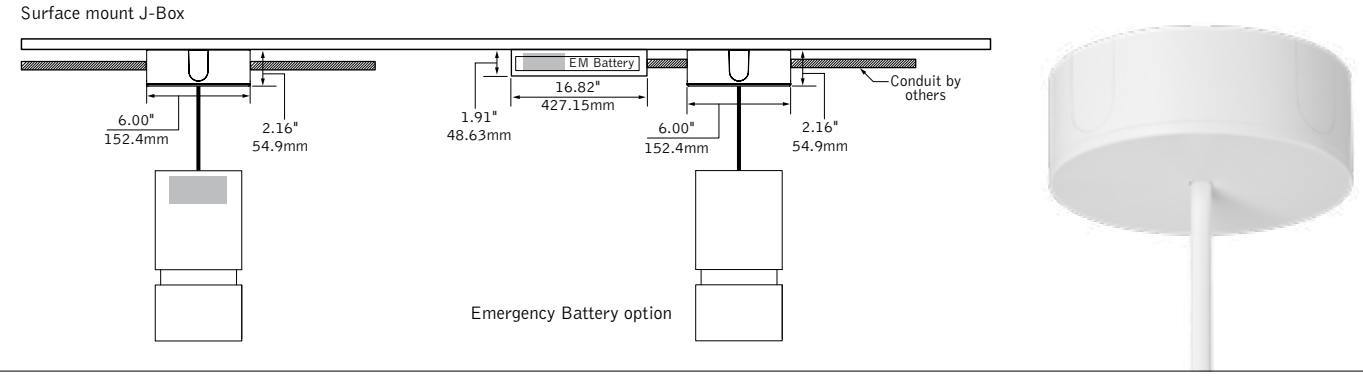
Indicates Driver Location



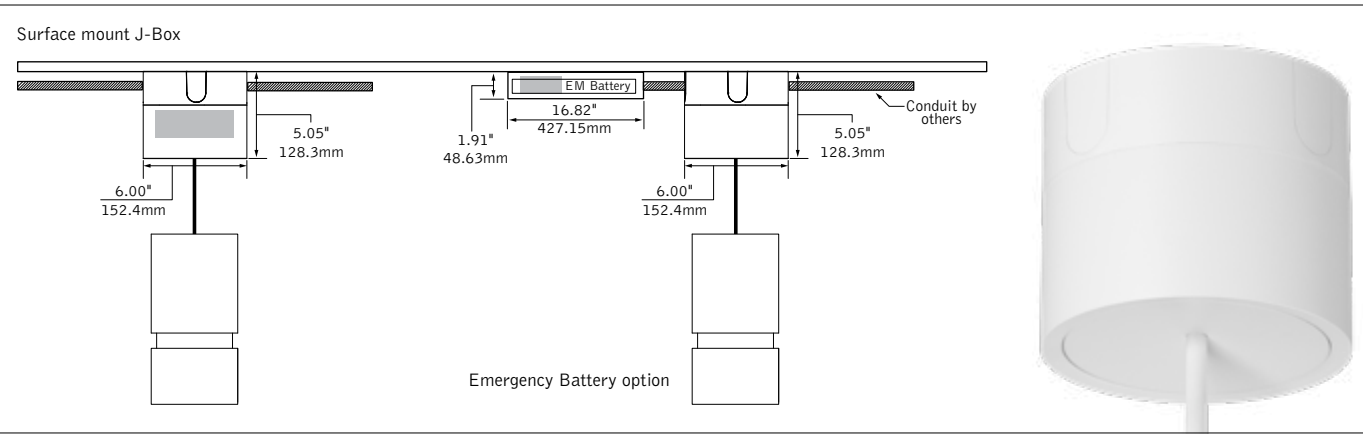
PC - Power Canopy



DSC - Shallow Canopy with decorative J-box cover, Integral Driver



DPC - Power Canopy with decorative J-box cover



4.5" CYLINDER LUMEN MULTIPLIER TABLE

Decorative Reveal

Trim Type	Optic	Decorative Reveal	Multiplier
Round [RD]	ALL	White Non-Glow Reveal [WHR]	0.94
		Black Non-Glow Reveal [BKR]	0.94
		White Glowing Reveal [WHG]	1.00

Color Temperature & CRI

Trim Type	Optic	Lumen Output	Color Temperature	Multiplier
Round [RD]	ALL	ALL	2700K, 80+ CRI [27K]	0.93
			2700K, 90+ CRI [927K]	0.78
			3000K, 80+ CRI [30K]	0.97
			3000K, 90+ CRI [930K]	0.81
			3500K, 80+ CRI [35K]	1.00
			3500K, 90+ CRI [935K]	0.83
			4000K, 80+ CRI [40K]	1.01
			4000K, 90+ CRI [940K]	0.86
		1500	2700-1800K, 90+ CRI [92718W]	0.76
		2500		0.90
		1500	3000-1800K, 90+ CRI [93018W]	1.07
		2500		0.88

Optic & Distribution (1000L - 1500L)

Trim Type	Optic	Distribution	Multiplier
Round [RD]	Tall Cone, 50˚ cut-off [DNT]	Spot (18˚) [SPL]	1.00
		Narrow Flood (27˚) [NFL]	0.97
		Flood (35˚) [FL]	0.93
		Wide Flood (54˚) [WFL]	1.00
		Very Wide Flood (69˚) [VWFL]	0.93
	Tall Cone, 50˚ cut-off with Solite Lens [DNTS]	Narrow Flood (27˚) [NFL]	1.00
	Super Short Cone, 80˚ cut-off [DSS]	Super Wide Flood (98˚) [SWFL]	0.85

Optic & Distribution (2000L - 3000L)

Trim Type	Optic	Distribtuon	Multiplier
Round [RD]	Tall Cone, 50˚ cut-off [DNT]	Narrow Flood (26˚) [NFL]	0.98
		Flood (41˚) [FL]	0.92
		Wide Flood (56˚) [WFL]	1.00
		Very Wide Flood (69˚) [VWFL]	0.89
	Tall Cone, 50˚ cut-off with Solite Lens [DNTS]	Narrow Flood (26˚) [NFL]	1.11
	Super Short Cone, 80˚ cut-off [DSS]	Super Wide Flood (98˚) [SWFL]	0.83

Multiplier tables are provided to aid with estimation of lumen levels across options. Apply multipliers against ordered Lumen Output to estimate Delivered Lumens. Refer to IES files for most accurate photometric information.

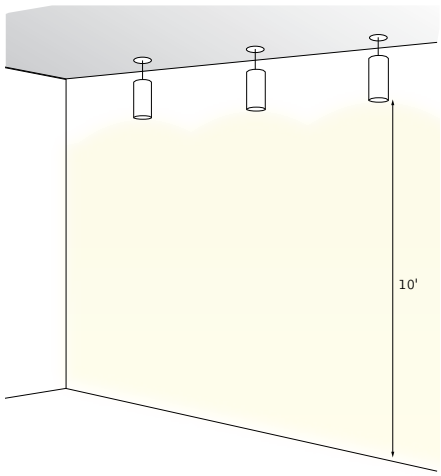
How To Use Lumen Multipliers

Formula: (Lumen Output Value) x (Decorative Reveal) x (Color Temperature & CRI) x (Optic & Distribution)

Example: FLCY4-RD-WHR-1000L-935K-DNT-FL
(1000) x (0.94) x (0.83) x (0.93) ≈ 726 lm (estimated delivered lumens)

NON-SCALLOPING SUPER WIDE FLOOD DESIGN GUIDE - 1500 LUMEN EXAMPLE

Distance from bottom of fixture		Footcandles																
		Fixtures 3' from Wall						Fixtures 3.5' from Wall						Fixtures 4' from Wall				
		3' OC			3.5' OC			3' OC			3.5' OC			3' OC			3.5' OC	
0 - 1'	3"	3	3	3	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
	6"	3	3	3	3	3	3	3	3	3	2	2	2	2	2	2	2	2	2
	9"	4	4	4	4	4	4	3	3	3	3	3	3	3	3	3	3	3	3
	12"	5	5	5	5	5	5	4	4	4	4	4	4	4	4	4	3	3	3
2'		13	13	13	11	11	11	9	9	9	8	8	8	8	8	8	7	7	7
3'		21	21	21	18	18	18	16	16	16	14	14	14	12	12	12	11	11	11
4'		24	24	24	20	20	20	20	20	20	17	17	17	17	17	17	14	14	14
5'		22	22	22	19	19	19	21	21	21	18	18	18	18	18	18	16	16	16
6'		19	19	19	16	16	16	19	19	19	16	16	16	18	18	18	15	15	15
7'		16	16	16	14	14	14	17	17	17	14	14	14	16	16	16	14	14	14
8'		14	14	14	12	12	12	14	14	14	12	12	12	15	15	15	13	13	13
9'		12	12	12	10	10	10	12	12	12	11	11	11	13	13	13	11	11	11
10'		10	10	10	8	8	8	10	10	10	9	9	9	11	11	11	9	9	9



Finishes

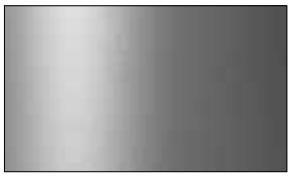
L8A
L8B
L8C

FOCAL POINT®

STANDARD FINISHES


WHITE WH


BLACK BK


PALLADIUM SILVER PS


CLEAR DIFFUSE CD

THE NATURALS (25% SCALE)


LIGHT OAK LOK


GRAY ELM GRE


CHESTNUT CHT


WALNUT WLT


WOVEN LINEN WLN

STANDARD COLOR COMBINATIONS*

Upper Housing Finish	Lower Housing Finish	Cord/Stem/Canopy Color
Black (BK)	Black (BK)	Black
	Light Oak (LOK)	
	Grey Elm (GRE)	
	Chestnut (CHT)	
	Walnut (WLT)	
	Woven Linen (WLN)	
White (WH)	White (WH)	White
	Light Oak (LOK)	
	Grey Elm (GRE)	
	Chestnut (CHT)	
	Walnut (WLT)	
	Woven Linen (WLN)	
Palladium Silver (PS)	Palladium Silver (PS)	Black
	Walnut (WLT)	
	Light Oak (LOK)	White
	Grey Elm (GRE)	
	Chestnut (CHT)	
	Woven Linen (WLN)	
Custom RAL color	Custom RAL color	White

Upper Housing Finish	Lower Housing Finish	Cord/Stem/Canopy Color
Walnut (WLT)	Walnut (WLT)	Black
	Black (BK)	
	Palladium Silver (PS)	
	White (WH)	White
Grey Elm (GRE)	Grey Elm (GRE)	White
	White (WH)	
	Palladium Silver (PS)	
	Black (BK)	Black
Light Oak (LOK)	Light Oak (LOK)	White
	White (WH)	
	Palladium Silver (PS)	
	Black (BK)	Black
Chestnut (CHT)	Chestnut (CHT)	White
	White (WH)	
	Palladium Silver (PS)	
	Black (BK)	Black
Woven Linen (WLN)	Woven Linen (WLN)	White
	White (WH)	
	Palladium Silver (PS)	
	Black (BK)	Black

*The Naturals finishes may be specified for shallow canopy (SC) and power canopy (PC) by adding the finish color to the canopy code. For example: Shallow Canopy in Light Oak = SCLOK.)

NULITE™

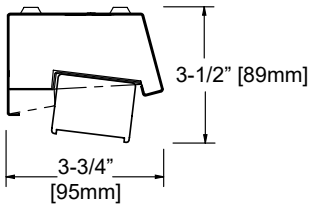
Regolo 4 LED Perimeter Series

L9A
L9B
L9C
L9D

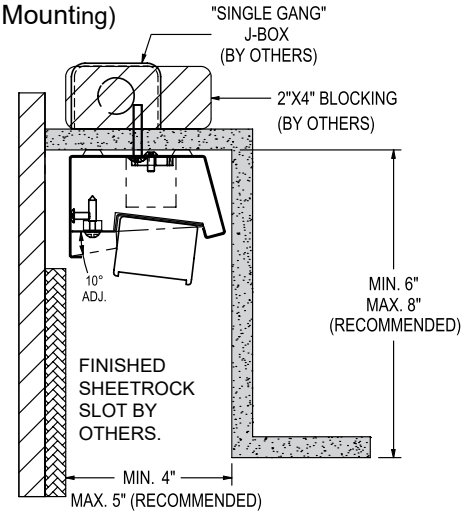
Type:	Project:	Qty:
	Date:	
Catalog #:		



Light Engine w/
Driver Housing



Trimless Slot
(Standard Mounting)



Description:

The Nulite Regolo RZ4 LED series is a narrow recessed perimeter slot system. The slender design is ideal for high-lighting textured walls in corridors, offices, classrooms, lobbies and general purpose rooms.

Specifications:

Housing Construction: The housing is formed cold rolled steel painted after fabrication. Secure housing to structure by appropriate fasteners by others.

The optional Grid, Flange or Mud Ring Back Box consists of visible extruded aluminum trim and cold rolled steel housing with heavy gauge end caps.

Standard finish is white powder coat after fabrication.

Light Engine / Distribution: The light engine consists of an extruded aluminum, black finish, base/heat sink with a linear LED array and extruded acrylic refractive lens. The "Stretto Optics" refractive lens yields a precise narrow distribution to graze down the wall surface with 10° field adjustment. An optional diffuser with white body and no refractor, softens the beam for a wider distribution. LED color is available in 3000K, 3500K or 4000K and in 80CRI or 90CRI. Module is replaceable. L90 ≥ 100,000 hrs.

Driver: Standard constant current electronic driver with 0-10V dimming input; dimming range from 100% down to 1%. Universal (UNV) voltage is from 120 - 277V, 50/60 Hz. Other dimming driver options are available.

Mounting: Surface, individual or continuous runs. Back box IC rated.

Labels: ETL listed, conforms to UL Standard 1598 and 8750, Damp location.

Warranty: 5-year limited warranty on LED and Driver.

Ordering Information

Sample: RZ4-07L35-UNV-D-1C-N-F-16'-BB

Series	Lumen Package[1] / LED Color		Voltage	Driver	Circuit	Optics	Mounting	Slot Length	Options
RZ4									
RZ4 (Perimeter System)	05 (~499 lm/ft, 4.73 W/ft)	*80CRI*	UNV	Dimming (0-10V)	1C Single Circuit	N Narrow Distribution "Stretto Optics" 22 Degree Beam	T Trimless Slot (Standard)	Slot Length[5] XX' - Specify slot length in half foot increments. Minimum length is 2'. Light engine will be approximately half a foot shorter than slot length.	BB[6] Back Box shipped prior to luminaire.
	07 (~765 lm/ft, 7.65 W/ft)	L30	120	D[3] (Dim to 1%)	1E Single Circuit w/ EM Circuit	W Wide Distribution	G[4] Grid Clg. Slot Back Box, see page 3.		BM[7] Base Mount (Uplight Vertical Surface)
	10 (~998 lm/ft, 10.23 W/ft)	L35	277	D0[4] (Dim to 1%, fade to off)	1B10 Single Circuit w/ 10WBattery Pack (CEC Compliant)		F[4] Flange Slot Back Box, see page 3.		***Consult Factory for Corners.***
		L40		D02[4] (Dim to 0%)	1B15 Single Circuit w/ 15WBattery Pack (CEC Compliant)		M[4] Mud Ring Slot Back Box, see page 3.		
		90CRI		Lutron Dimming					
		H30		See Page 2 for Ordering Codes					
		H35		DALI Dimming					
		H40		*eldoLED ECOdrive* ELE (Dim to 1%)					
				eldoLED SOLOdrive ELS (Dim to 0%)					

Notes:

1. *Nominal lumen output per foot.*
2. *Standard driver, do not connect low-voltage wires for non-dimming applications. Consult factory for specifications and manufacturer.*
3. *Consult factory for specifications and manufacturer.*
4. *Back boxes can be shipped prior to the luminaires. Use option code BB.*
5. *1" increments are available slot lengths, consult factory.*
6. *BB option is only available for G, F or M mounting options.*
7. *BM (Base Mount) only available for T mounting.*

nled Technology

Specifications and dimensions are subject to change without notification. Specification sheets on our website supersede all other versions. 2019 Rev. E1
Nulite reserves the right to bulk package any order.

Nulite Lighting 10770 East 51st Avenue, Denver, CO 80239 Phone 303-287-9646 Fax 303-287-0316 www.nulite-lighting.com

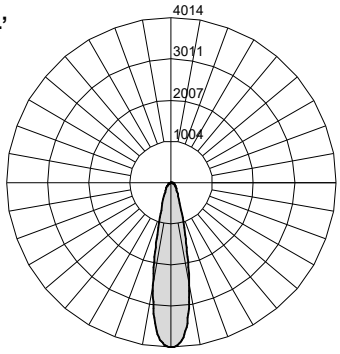
Lutron Driver Ordering Codes

Nulite Code	Lutron Prefix	Lutron Series	Dim Level	Quantity of Wires	Dim to Dark (Smooth)
L11*	PEQ	Hi-Lume™ Premiere	0.1%	2	X
L12	LTEA	Hi-Lume™ 2-Wire 120V forward phase	1%	No Control Wires - Uses Hot	
L15	LDE1	Hi-Lume™ H-Series	1%	2	X
L16	LDE5	Hi-Lume™ 5-Series	5%	2	

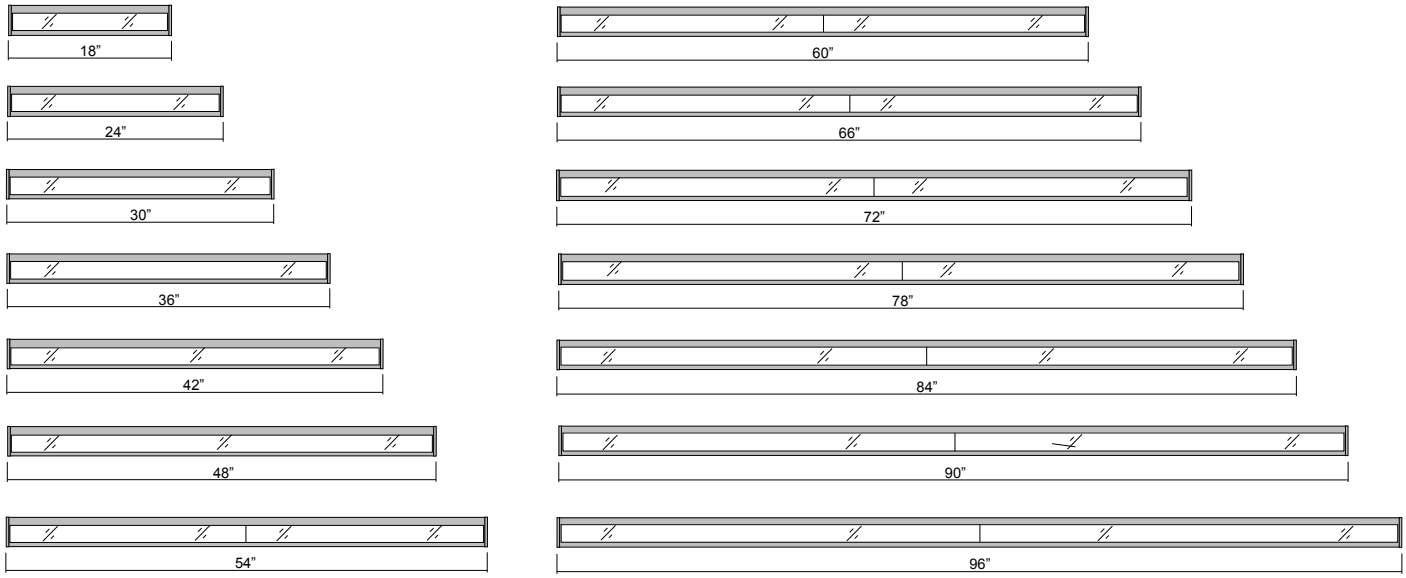
*Maximum lumen package with L11 is 05

Photometric Curve

Cat. # RZ4-07L35-...-N-...-4'
Narrow Distribution
Wattage - 30.6
Lumens/Watt - 100.3



Individual Luminaire Lengths (Light Engine(s) w/ Driver Housing)



Continuous Slot Lengths

Slot Run Length (Consult factory for custom lengths)

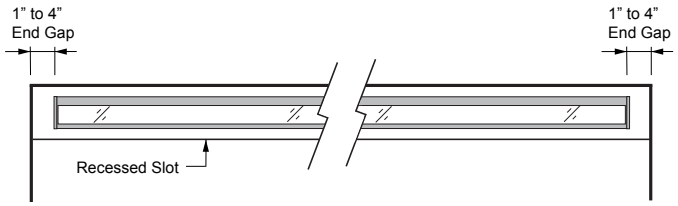
Length and Number of Luminaires

	2'	2.5'	3'	3.5'	4'	4.5'	5'	5.5'	6'	6.5'	7'	7.5'	8'	8.5'	9'	9.5'	10'	10.5'	11'	11.5'	12'	12.5'	13'	13.5'	14'	14.5'	15'	15.5'	16'	16.5'	17'	17.5'	18'	18.5'	19'	19.5'	20'	20.5'	21'	21.5'	22'	22.5'	23'	23.5'	24'
1.5'	1																																											
2'		1																																										
2.5'			1																																								
3'				1																																							
3.5'					1																																						
4'						1								2	1	1	1	1	1	1	1	1								2	1	1	1	1	1	1	1	1							
4.5'							1								1								1								1								1						
5'								1								1								1								1								1					
5.5'									1								1								1								1								1				
6'										1								1								1								1								1			
6.5'											1								1								1								1								1		
7'												1								1								1								1								1	
7.5'													1								1								1								1								1
8'																						1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	2	2	2	2	2	2	2	2

Luminaire run length is 6" shorter than the slot length.

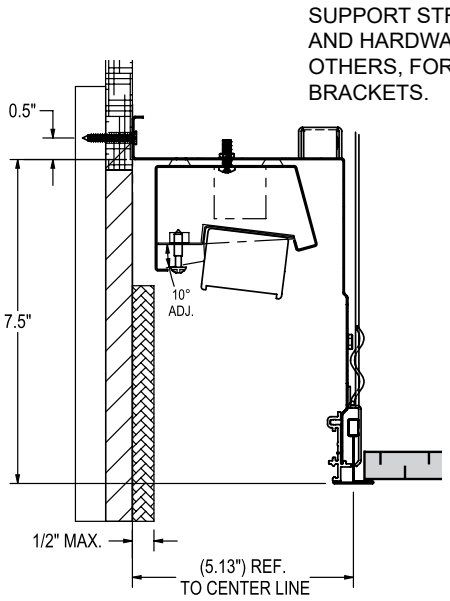
Recommended End Gaps

NULITE RECOMMENDS A MINIMUM OF 1" END GAP BETWEEN THE LUMINAIRE AND THE END OF THE SLOT. MINIMUM SLOT LENGTH IS 2'. WE PROVIDE SUBMITTAL DRAWINGS FOR EACH RUN LENGTH. OUR STANDARD GAP IS 3" PER END FOR ALL 6" INCREMENT RUNS.

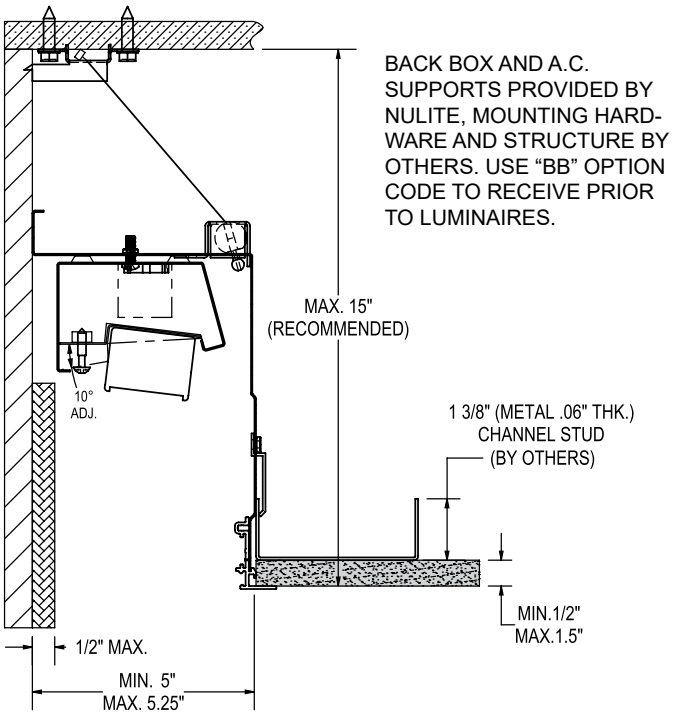


Reflected Ceiling Plan of a Slot

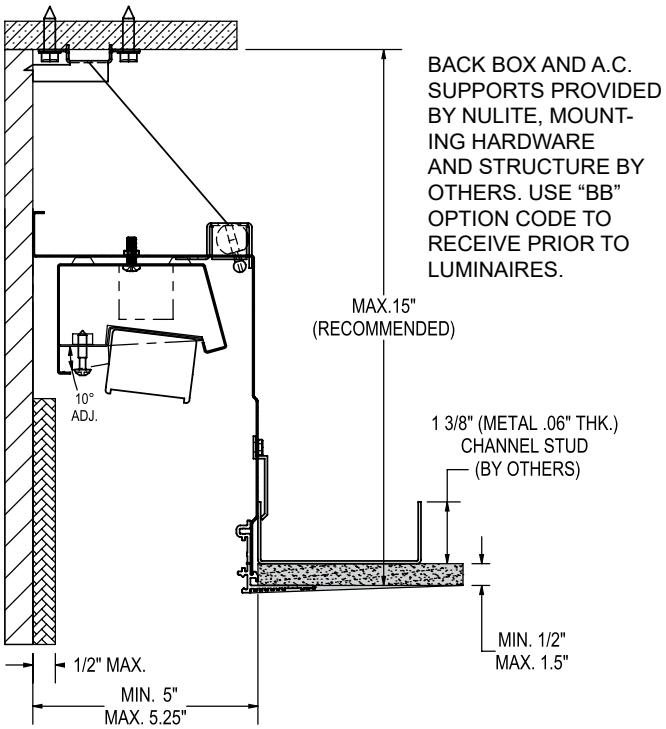
Grid Ceiling Slot Back Box



Flange Slot Back Box



Mud Ring Slot Back Box



Lia™

DECORATIVE ACOUSTIC LED PENDANT

L10A
L10B
L10C
L10D

FOCAL POINT®



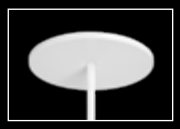
48" Shade | 12" Height



48" Shade | 18" Height

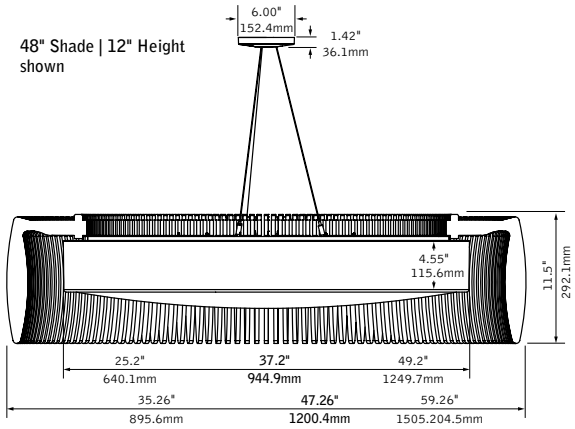


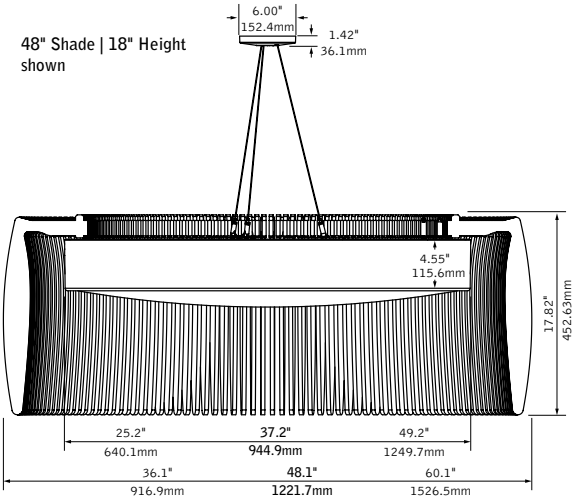
cable mount
canopy detail



stem mount
canopy detail

DIMENSIONAL DATA (continued on page 4)





FEATURES

Decorative PET felt shaded pendant available in 6 sizes.

Nominal 36", 48" or 60" diameter and nominal 12" or 18" height.

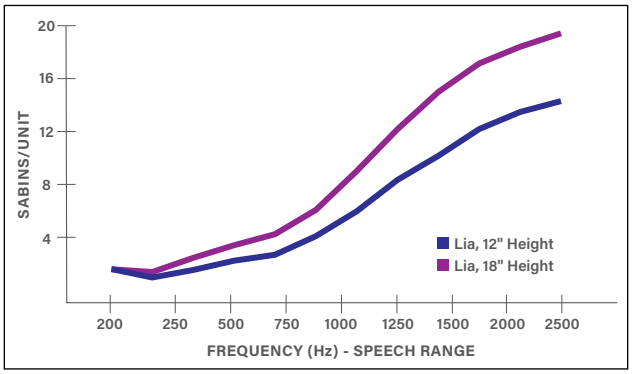
Convex lens design ensures an evenly illuminated diffuser.

Wide range of color options provides design flexibility and personalization for any project.

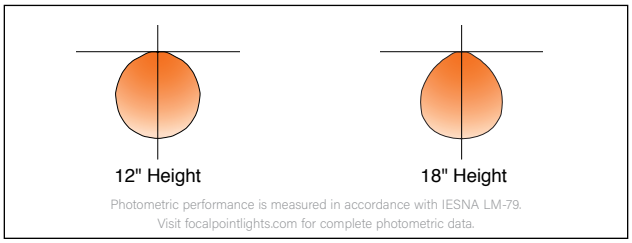
Excellent choice for open public spaces such as airport concourses, large lobbies, reception areas and meeting rooms.

PoE compatible: Integrates with Power over Ethernet lighting systems via standard, low-voltage wires.

ACOUSTIC PERFORMANCE



DISTRIBUTIONS



Photometric performance is measured in accordance with IESNA LM-79.
Visit focalpointlights.com for complete photometric data.

fixture: project:

SPECIFICATIONS

Acoustic Material

Content	Housing material is 100% polyester containing up to 50% of recycled plastic bottles (PET felt) with an ASTM E-84 Class A / CAN ULC S102 fire rating and is moisture resistant. See page 3 for color offering. Acoustic material colors are subject to change without notice. For the most current color options, please visit focalpoint-lights.com/acousticsolutions. Lead times may vary depending on color.
Cleaning and Care	Remove dust and debris with a clean, soft, lint-free cloth or vacuum
PET Thickness	9mm
NRC	0.9

LED System

LED module incorporates premium LEDs on a robust platform to achieve excellent thermal management. LEDs are placed to promote a uniform appearance. Available in 2700K, 3000K, 3500K or 4000K with CRI>80 or CRI>90. 3500K and 4000K with CRI>90 have a cyanosis observation index (COI) of 3.3 or less. LED modules and drivers are replaceable from below.

Light Engine Construction

18 Ga. spun steel housing. 18 Ga. spun steel mounting pan. Light engine 25.2", 36.12" or 48.2" diameter x 4.5"H. Housing secured to mounting pan by torsion springs.
12" minimum suspension. 36" unit weight: 43lbs, 48" unit weight: 80lbs, 60" unit weight: 110lbs.

Optic

20 Ga. steel reflector finished in High Reflectance White powder coat. Convex lens of .125" thick white acrylic is secured to housing and removed with torsion springs.

Electrical

Standard 120-277V driver includes 0-10V analog dimming. Power factor > .9. PoE compatible: Integrates with Power over Ethernet lighting systems via standard, low-voltage wires.

Emergency Battery

Bodine BSL310–CAN. Emergency output—10 watts for 90 minutes.

Labels

UL and cUL Listed. Suitable for Dry or Damp Locations, indoor use only.

Trim/Canopy/Stem Finish

Polyester powder coat applied over a multi-stage pre–treatment.

Lumen Maintenance

Reported: L70 at >54,000 hours Calculated: L70 at 76,000 hours
(Derived from EPA TM-21 calculator. Based on typical conditions, consult factory for additional data.)

Reliability

At Focal Point, our products are designed to stand the test of time. Each luminaire is engineered using superior components, manufactured with the utmost care and rigorously tested. Contact us for reliability data.

Warranty

LED system rated for operation in ambient environments up to 25°C. 5 year limited warranty.

PERFORMANCE CHART

Nominal Size	Height	Lumen Output	Delivered Lumens	Tested System Watts	LPW
2' Light Engine 36" Shade	12"	2000L	1737	29.8	56.5
		3000L	2601	46.1	58.3
		4000L	3566	65.4	56.4
	18"	2000L	1654	29.8	55.5
		3000L	2476	46.1	53.7
		4000L	3395	65.4	51.9
3' Light Engine 48" Shade	12"	4000L	4156	58.3	71.3
		5000L	5088	72.2	70.5
		7000L	7181	104.7	68.2
		9000L	9360	140.3	66.7
	18"	4000L	3927	58.3	67.4
		5000L	4808	72.2	66.6
		7000L	6786	104.7	64.8
		9000L	8845	140.3	63.0
4' Light Engine 60" Shade	12"	7000L	7381	89.6	82.4
		9000L	9093	111.4	81.6
		11000L	11375	141.2	80.5
		14000L	14342	181.4	79.1
		17000L	17604	227.4	77.4
	18"	7000L	7198	89.6	80.4
		9000L	8867	111.4	79.6
		11000L	11093	141.2	78.5
		14000L	13986	181.4	77.1
		17000L	17167	227.4	75.5

Based on 3500K, 80 CRI. Lumen multiplier: 90+ CRI = 0.87. Lumen output may vary +/- 8%. Actual wattage may vary +/- 5%

Focal Point LLC reserves the right to change specifications for product improvement without notification.

ACOUSTIC SHADE ORDERING

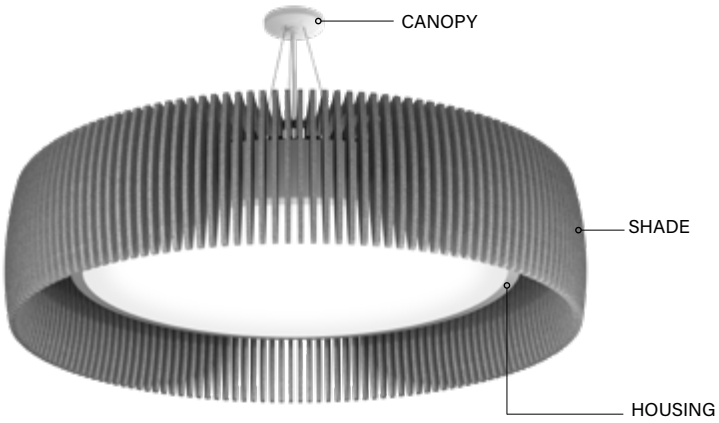
L10A
L10B
L10C
L10D

Series		**DLIA**
Lia	DLIA	
Nominal Size (Shade and light engine sizes are paired)		
36" Shade for 2' light engine	36S	
48" Shade for 3' light engine	48S	
60" Shade for 4' light engine	60S	
Profile		**CRV1**
Curve 1	CRV1	
Height		
12"	12	
18"	18	
Acoustic Shade Color See page 3 for PET color offering	___	

LIGHT ENGINE ORDERING

Luminaire Series			**FSDL**
Skydome LED		FSDL	
Nominal Size (Shade and light engine sizes are paired)			
2' Light Engine for 36" Shade		22	
3' Light Engine for 48" Shade		33	
4' Light Engine for 60" Shade		44	
Shielding			**CX**
Frosted Lens		CX	
Lumen Output			
2' Light Engine 36" Shade	2000 Lumen	2000L	
	3000 Lumen	3000L	
	4000 Lumen	4000L	
3' Light Engine 48" Shade	4000 Lumen	4000L	
	5000 Lumen	5000L	
	7000 Lumen	7000L	
	9000 Lumen	9000L	
4' Light Engine 60" Shade	7000 Lumen	7000L	
	9000 Lumen	9000L	
	11,000 Lumen	11000L	
	14,000 Lumen	14000L	
	17,000 Lumen	17000L	
Color Temperature			
2700K, 80+ CRI **or** 90+ CRI		27K **or** 927K	
3000K, 80+ CRI **or** 90+ CRI		30K **or** 930K	
3500K, 80+ CRI **or** 90+ CRI		35K **or** 935K	
4000K, 80+ CRI **or** 90+ CRI		40K **or** 940K	
Circuit			**1C**
Single Circuit		1C	
Voltage			
120/277 UNV Volt		UNV	
Low Voltage		LV	
Driver			
0-10V - 1% Dimming		L11	
0-10V - 10% Dimming		LD1	
Low Voltage, PoE compatible (No driver. Not available with EM or EC. LV Voltage only.)		LVN	
Lutron Hi-Lume EcoSystem (LDE1) - 1% Dimming		LH1	
Mounting			
24" Aircraft Cable		C24	
48" Aircraft Cable		C48	
96" Aircraft Cable		C96	
12" Rigid Stem		S12	
18" Rigid Stem		S18	
24" Rigid Stem		S24	
36" Rigid Stem		S36	
48" Rigid Stem		S48	
(White stems and canopies supplied standard. For non-white housings: to match stem and housing color, add M to ordering code (S12M). To match stem, canopy and housing color, add MC to ordering code (S12MC) (Consult factory for other lengths)			
Factory Options			
LiaLight Engine		DLIA	**DLIA**
Black Cord		BKCD	
Emergency Battery		EM	
Finish			
Matte Satin White		WH	
Titanium Silver		TS	
Matte Black		BK	
Modest Mushroom - Gloss		MM	

DECORATIVE FINISHES



Paint Finishes


BLACK **BK**


WHITE **WH**


TITANIUM SILVER **TS**


MODEST MUSHROOM **MM**

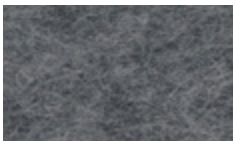
PET Material

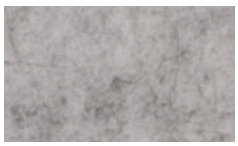
STANDARD COLORS


PURE BLACK **PBK**


CHARCOAL GRAY **CHG**

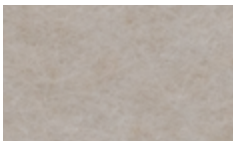

SLATE **SLT**


SHADOW GRAY **SDG**


SILVER GRAY **SLG**


PEARL ICE **PIC**

CLASSIC WHITE **CWH**


NATURAL LINEN **NTL**


HAZELWOOD **HZW**

PREMIUM COLORS*


CORNFLOWER BLUE **CFB**


DENIM BLUE **DNB**


MIDNIGHT BLUE **MNB**


DEEP PURPLE **DPP**


DEEP WATER **DWT**


SEAFOAM **SFM**


EMERALD GREEN **EMG**


BRICK RED **BRD**


CHERRY RED **CHR**


BERRY **BRY**


BLUSH **BLS**


CARROT **CRT**


PINEAPPLE **PNA**


CINNAMON **CNM**


LIMESTONE **LMS**


Declare.

9mm PET Felt
Focal Point, LLC

Final Assembly: Chicago, Illinois, USA
Life Expectancy: 30 Year(s)
End of Life Options: Salvageable/Reusable in its Entirety, Recyclable (100%)

Ingredients:

Polyethylene terephthalate: PET; **N, N'-Ethylene bisstearamide:** Octadecanamide, N,N'-1,2-ethanediylbis-; **Stearic Acid:** Stearic Acid; **Antioxidant 1076:** Benzenepropanoic acid, 3,5-bis(1,1-dimethylethyl)-4-hydroxy-, octadecyl ester; **Antioxidant KY-405:** Benzenamine, 4-(1-methyl-1-phenylethyl)-N-[4-(1-methyl-1-phenylethyl)phenyl]-; **Titanium Dioxide:** Titanium dioxide

Living Building Challenge Criteria: Compliant

I-13 Red List:
■ LBC Red List Free
□ LBC Red List Approved
□ Declared
% Disclosed: 100% at 100ppm
VOC Content: Not Applicable

I-10 Interior Performance: CDPH Standard Method v1.1-2010
I-14 Responsible Sourcing: Not Applicable

FPL-0001
EXP: 01 MAR 2024
Original Issue Date: 2020

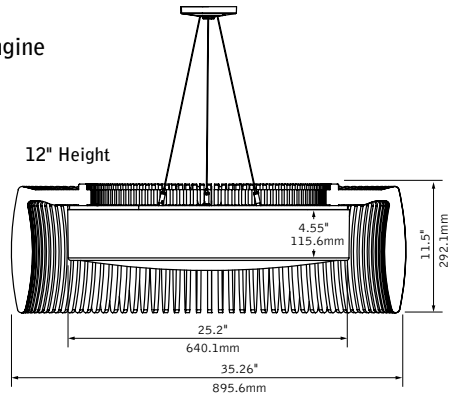
INTERNATIONAL LIVING FUTURE INSTITUTE™ living-future.org/declare

*Contact factory for lead time and pricing.

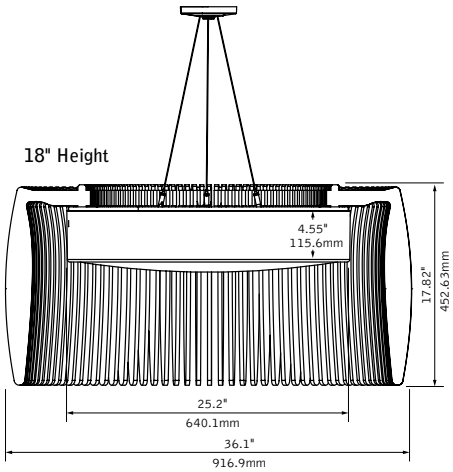
DIMENSIONAL DATA CONTINUED

36" Shade
2' Light Engine

12" Height

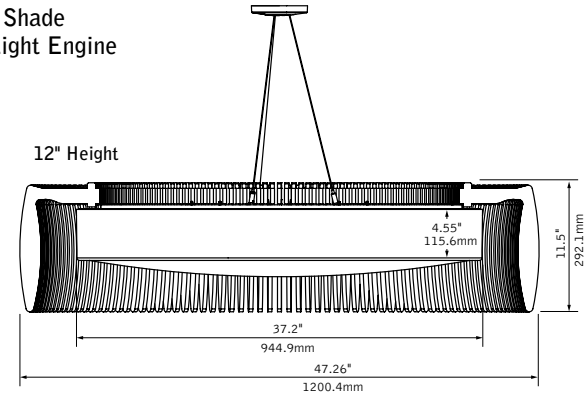


18" Height

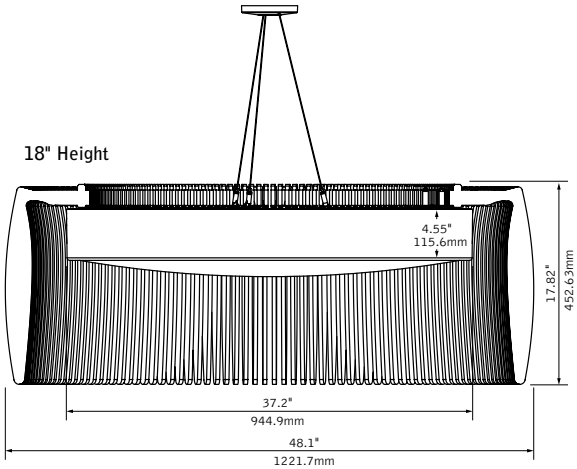


48" Shade
3' Light Engine

12" Height

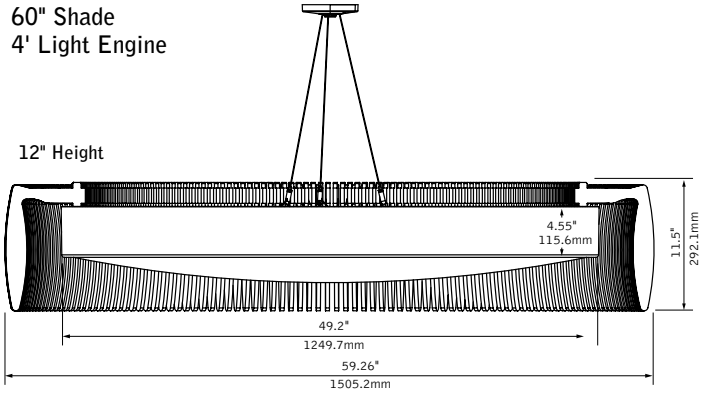


18" Height

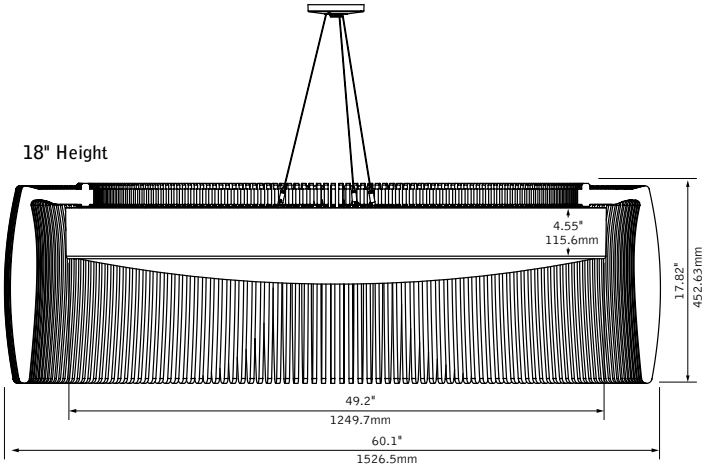


60" Shade
4' Light Engine

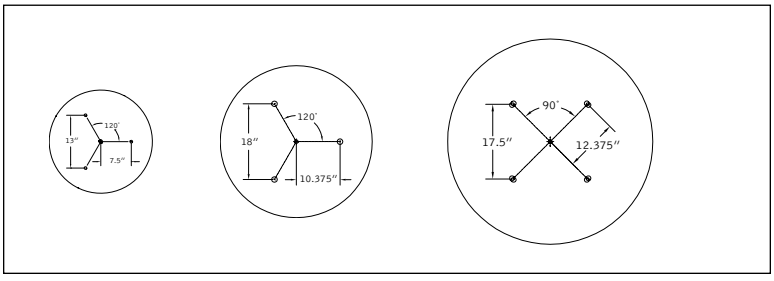
12" Height



18" Height



STEM MOUNTING INFORMATION



L11
L11A

ENVIROPRO™ LOW BAY

EPLB SERIES

PROJECT INFORMATION

Job Name _____

Fixture Type _____

Catalog Number _____

Approved by _____

PRODUCT FEATURES:

- Classic industrial high-bay luminaire design aesthetic with modern lamp technology
- Suitable for applications requiring higher vertical illuminance levels
- Available with up to 28% uplight, depending on model
- Multiple flux and lamp color options



12" 16" 22"

SPECIFICATIONS

HOUSING: Marine-grade die-cast aluminum construction with convective fins for efficient thermal transfer from junction to ambient. Sealed center hub for pendant or hook & loop mounting.

REFLECTOR/LENS ASSEMBLY: REFLECTOR (ACA, ACP, AO): .063" corrosion-resistant spun aluminum reflector, sealed to housing with continuous closed-cell gasket. Standard gloss white high-reflectance TGIC polyester powder coat on spun reflector with 5-stage pre-treatment. Reflectance 90%. Salt spray test: 1,000 hours. For additional reflector finishes, see Ordering Options below. RMH Option: Finish matches housing finish only—inside will remain gloss white. REFRACTOR (CA, CP): Clear prismatic UV-stabilized acrylic or polycarbonate reduces contrast and improves uniformity utilizing its inherent uplight component, sealed to housing with continuous closed-cell gasket. REFRACTOR (PPA): Pearlescent Prismatic UV-stabilized acrylic providing specifically tailored uplight and downlight levels, sealed to housing with continuous closed-cell gasket. ENCLOSED (E): Available with either a spun aluminum reflector or acrylic/polycarbonate refractor, and a clear prismatic acrylic or polycarbonate drop (bottom) lens.

ELECTRICAL: High-brightness LED array. See Ordering Information for color temperature and CRI options. 80 CRI min. (12"), 70 CRI min. (16/22"). 120-277VAC, or 347VAC, 50/60Hz electrical input. Replaceable high power factor electronic, constant-current driver (<10% THD, >0.90PF). Minimum 85% driver efficiency. 12" MODEL: 0-10V dimming protocol with 1-100% range (includes dim-to-dark capabilities on 42L), 250µA max. source current. 16/22" Model: 0-10V dimming protocol with 10-100% range without dim-to-dark capabilities; 300µA max. source current.

TEKLINK™ TL100: Centralized, wired zonal occupancy and closed-loop daylight harvesting control system. TL100 controllers are standalone devices and ordered separately for luminaire. Click here for specifications.

INSTALLATION: Tool-free lamp access. LOOP HANGER: Top hub with loop style hanger and 6' black power cord. IP65 sealed connector. Hook by others. Center of gravity along center axis of luminaire. PENDANT: Sealed threaded hub supplied for ½" diameter rigid pendant (12" size) and ¾" diameter rigid pendant (16"/22" size). Pendant components by others. Ambient temperature rating is -40°C to 40°C (55°C on 47L/94L).

PHOTOMETRICS: Photometry tested to the IESNA LM-79-08 standard by an ILAC/ISO17025 accredited laboratory. For additional photometric data, please go to www.kenall.com.

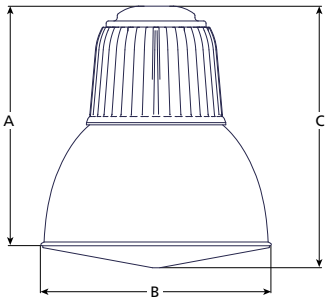
WARRANTY: Limited five (5) year LED warranty.

LISTINGS: Listed to UL Standards by Intertek Testing Laboratory for Wet Location (Enclosed) and Dry Location (Open). Enclosed version rated IP65 per IEC 60598. Enclosed version certified to NSF2 Splash/Non-Food Zone.

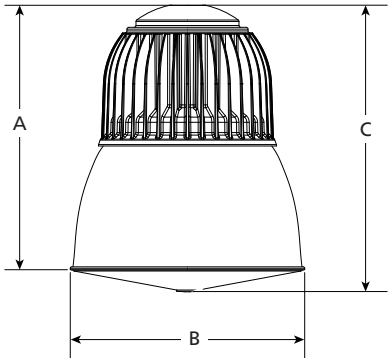
LED IP65 TYPE (E) ONLY

DIMENSIONAL DATA

12" REFLECTOR SIZE



16"/ 22" REFLECTOR SIZE



DIMENSIONAL DATA (IN INCHES)

	A	B	C
12"	12.95	12.46	14.14
16"	17.93	16.22	19.46
22"	21.96	22.46	23.96

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L11
L11A

ENVIROPRO™ LOW BAY

PROJECT INFORMATION

Job Name _____

Fixture Type _____

Catalog Number _____

Approved by _____

ORDERING INFORMATION (Ex: EPLB-22-E-CA-ALG-192L-40K7-DCC-120)

Model	Size	Enclosure Type	Mount Type	Lens/Refl/Refr	Finish	Lamp Power	Lamp Color	Driver Type	Voltage	Options
EPLB								**DCC**		

L11A
L11

Reflector Size
- **12** 12" Nominal Diameter
- **16** 16" Nominal Diameter
- **22** 22" Nominal Diameter

Enclosure Type
- **E** Enclosed (IP65/Wet Location)
- **O** Open (Dry Location)

Mounting Type
- **HL** Loop Hanger with 6' Black Cord and IP65-Rated Quick-Disconnect Plug
- **PM** Pendant Mount (by others)

Lens/Reflector/Refractor Type
- **ACA**† Spun Aluminum Reflector w/Clear Acrylic Drop Lens (Enclosure Type E only)
- **ACP**† Spun Aluminum Reflector w/Clear PC Drop Lens (Enclosure Type E only)
- **AO**† Open Spun Aluminum Reflector (Enclosure Type O only)
- **CA** Clear Prismatic Acrylic Refractor
- **PPA** Pearlescent Prismatic Acrylic Refractor
- **CP** Clear Prismatic Polycarbonate Refractor

NOTE: When the PPA Lens/Refractor is selected in conjunction with the E Enclosure type, the front/bottom lens comes in clear prismatic acrylic.

Housing Finish
- **ALG** Antimicrobial Low Gloss White
- **BR** Bronze
- **CS** Cool Satin Painted Aluminum
- **DB** Dark Bronze
- **FG** Forest Green
- **GW** Gloss White
- **LG** Light Gray
- **MB** Matte Black
- **MW** Matte White
- **WS** Warm Satin Aluminum
- **CC** Custom Color

Lamp Power

12"
- **17L** 17 Watt LED
- **25L** 25 Watt LED

L11A
- **42L** 42 Watt LED

16"
- **47L** 47 Watt LED

L11
- **94L** 94 Watt LED
- **144L** 144 Watt LED
- **192L** 192 Watt LED

22"
- **94L** 94 Watt LED
- **144L** 144 Watt LED
- **192L** 192 Watt LED

Lamp Color
- **30K8** 3000K/80CRI min
- **30K9** 3000K/90CRI min
- **35K8** 3500K/80CRI min
- **35K9** 3500K/90CRI min
- **40K7*** 4000K/70CRI min
- **40K8** 4000K/80CRI min
- **40K9▲** 4000K/90CRI min
- **50K7*** 5000K/70CRI min

Driver Type
- **DCC** Dimming Constant-Current LED Driver (0-10V)

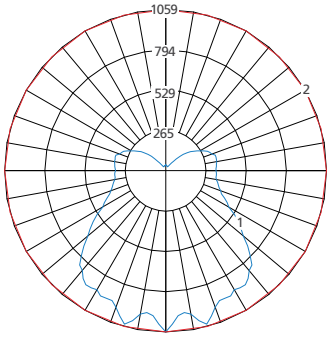
Voltage
- **DV** 120-277 Volts (n/a with 12" Reflector Size)
- **120** 120 Volts
- **277** 277 Volts
- **347** 347 Volts

Options
- **LELC**‡§ Ceiling Mounted LED Emergency Battery Backup (to view dimensional drawing click here)
- **LELP**‡§ Pendant Mounted LED Emergency Battery Backup (to view dimensional drawing click here)
- **FS** Single Fuse & Holder
- **NAT** Natatorium Environment (n/a with Loop Hanger (HL) on the EPLB12; N/A with 192L Lamp Power)
- **PM24**‡• Pendant Mount, Single Pendant (to view image details click here)
- **SCH** Safety Chain & Hanger (n/a with PM Mount)
- **WG*** Wire Guard
- **RMH**† Reflector Matches Housing
- **TL100** TekLink TL100 Control System (Click here for specifications)

‡ Damp Location when ordered with Enclosure Type 'E'
Cannot be combined with 'NAT' Option
Available only with 'PM' Mounting Type
• 24" std. length. Consult factory for custom lengths (96" max. length)
† Standard reflector is gloss white inside & outside. With RMH Option, spun reflector finish will match Housing Finish selection outside only
§ Available only with 'PM' Mounting Type
* n/a with EPLB-12
▲ EPLB-12 only

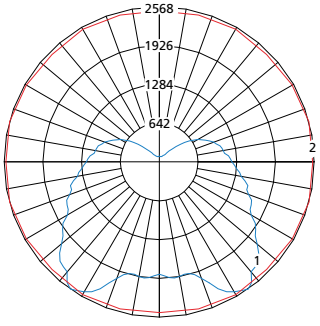
PERFORMANCE

Model: EPLB-12-E-CA-42L-40K8-DCC



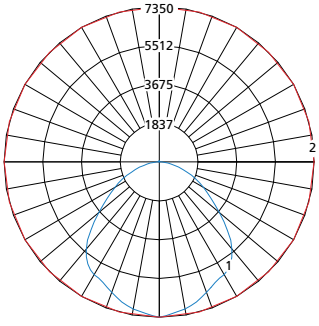
Max Candela = 1059 Located At Horiz. Angle = 0, Vertical Angle = 0
1 - Vertical Plane Through Horiz. Angles (0-180) (Through Max. Cd.)
2 - Horizontal Cone Through Vert. Angle (0) (Through Max. Cd.)

Model: EPLB-16-E-CA-GW-144L-40K7-DCC-DV



Max Candela = 2568 Located At Horiz. Angle = 15, Vertical Angle = 35
1 - Vertical Plane Through Horiz. Angles (15-195) (Through Max. Cd.)
2 - Horizontal Cone Through Vert. Angle (35) (Through Max. Cd.)

Model: EPLB-22-E-ACA-GW-192L-40K7-DCC-DV



Max Candela = 6915 Located At Horiz. Angle = 0, Vertical Angle = 0
1 - Vertical Plane Through Horiz. Angles (0-180) (Through Max. Cd.)
2 - Horizontal Cone Through Vert. Angle (0) (Through Max. Cd.)

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ENVIROPRO™ LOW BAY

EPLB SERIES – TECHNICAL DATA

For additional photometry, go to www.kenall.com

PERFORMANCE– 12" & 16"

		Flux @ 25C, By Optic Type (lm)						
Reflector Size	Lamp Code	E-CA	E-ACA	O-CA	O-AO	Efficacy (lm/W)	Input Power (W)	Estd. L_{70} LED Life (Hrs)
12	17L-40K8	2,325	1,864	2,456	2,093	98 - 129	19	115,000
	17L-40K9	1,979	1,586	2,090	1,781	83 - 110	19	115,000
	17L-35K8	2,350	1,884	2,482	2,115	99 - 130	19	115,000
	17L-35K9	1,931	1,548	2,039	1,738	81 - 107	19	115,000
	17L-30K8	2,297	1,841	2,426	2,067	97 - 127	19	115,000
	17L-30K9	1,885	1,511	1,991	1,697	79 - 105	19	115,000
	25L-40K8	3,273	2,623	3,457	2,946	99 - 130	27	95,000
	25L-40K9	2,786	2,233	2,942	2,507	84 - 110	27	95,000
	25L-35K8	3,309	2,652	3,494	2,977	100 - 131	27	95,000
	25L-35K9	2,718	2,178	2,871	2,446	82 - 108	27	95,000
	25L-30K8	3,234	2,592	3,415	2,910	97 - 128	27	95,000
	25L-30K9	2,654	2,127	2,803	2,388	80 - 105	27	95,000
	42L-40K8	5,090	4,079	5,375	4,580	85 - 112	48	75,000
	42L-40K9	4,332	3,471	4,574	3,898	73 - 96	48	75,000
	42L-35K8	5,145	4,123	5,433	4,630	86 - 114	48	75,000
	42L-35K9	4,227	3,387	4,464	3,803	71 - 93	48	75,000
	42L-30K8	5,029	4,030	5,311	4,525	84 - 111	48	75,000
	42L-30K9	4,127	3,307	4,358	3,714	69 - 91	48	75,000
16	47L-50K7	5,669	4,947	5,994	5,429	90 - 109	55	150,000
	47L-40K7	5,654	4,935	5,979	5,415	90 - 109	55	150,000
	47L-40K8	5,297	4,623	5,601	5,073	84 - 102	55	150,000
	47L-35K8	5,069	4,424	5,360	4,855	80 - 97	55	150,000
	47L-35K9	3,471	3,029	3,670	3,324	55 - 67	55	150,000
	47L-30K8	5,069	4,424	5,360	4,855	80 - 97	55	150,000
	47L-30K9	3,471	3,029	3,670	3,324	55 - 67	55	150,000
	94L-50K7	10,485	9,151	11,087	10,042	86 - 105	106	125,000
	94L-40K7	10,459	9,128	11,059	10,016	86 - 104	106	125,000
	94L-40K8	9,798	8,551	10,360	9,383	81 - 98	106	125,000
	94L-35K8	9,376	8,183	9,914	8,979	77 - 94	106	125,000
	94L-35K9	6,419	5,603	6,788	6,148	53 - 64	106	125,000
	94L-30K8	9,376	8,183	9,914	8,979	77 - 94	106	125,000
	94L-30K9	6,419	5,603	6,788	6,148	53 - 64	106	125,000
	144L-50K7	15,654	13,662	16,553	14,992	84 - 102	162	125,000
	144L-40K7	15,615	13,628	16,511	14,954	84 - 102	162	125,000
	144L-40K8	14,628	12,766	15,468	14,009	79 - 95	162	125,000
	144L-35K8	13,998	12,217	14,802	13,406	75 - 91	162	125,000
	144L-35K9	9,584	8,365	10,134	9,179	52 - 63	162	125,000
	144L-30K8	13,998	12,217	14,802	13,406	75 - 91	162	125,000
	144L-30K9	9,584	8,365	10,134	9,179	52 - 63	162	125,000
	192L-50K7	20,411	16,569	21,583	19,548	79 - 103	210	105,000
	192L-40K7	20,360	16,527	21,529	19,499	79 - 103	210	105,000
	192L-40K8	19,073	15,482	20,168	18,266	74 - 96	210	105,000
	192L-35K8	18,252	14,816	19,300	17,480	71 - 92	210	105,000
	192L-35K9	12,497	10,144	13,214	11,968	48 - 63	210	105,000
	192L-30K8	18,252	14,816	19,300	17,480	71 - 92	210	105,000
	192L-30K9	12,497	10,144	13,214	11,968	48 - 63	210	105,000

Displayed information is for selected luminaires only. Information is subject to change without notice.
Visit www.kenall.com for IES files and additional information.

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ENVIROPRO™ LOW BAY

EPLB SERIES – TECHNICAL DATA

PERFORMANCE – 22"

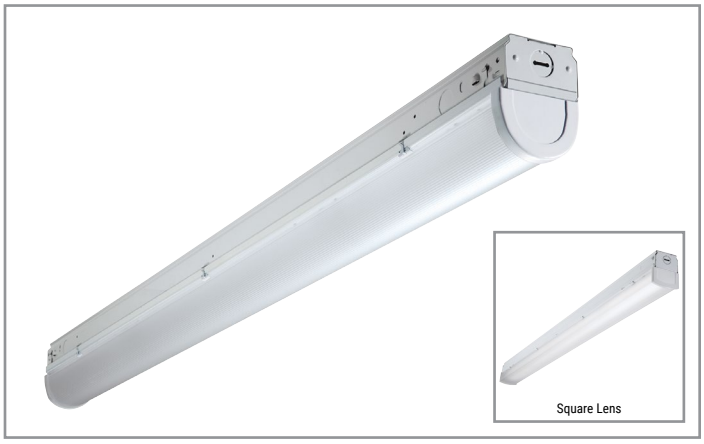
		Flux @ 25C, By Optic Type (lm)						
Reflector Size	Lamp Code	E-CA	E-ACA	O-CA	O-AO	Efficacy (lm/W)	Input Power (W)	Estd. L_{70} LED Life (Hrs)
22	94L-50K7	12,366	9,697	12,455	10,377	91 - 117	106	150,000
	94L-40K7	12,335	9,673	12,424	10,351	91 - 117	106	150,000
	94L-40K8	11,555	9,061	11,638	9,697	85 - 110	106	150,000
	94L-35K8	11,058	8,671	11,137	9,280	82 - 105	106	150,000
	94L-35K9	7,571	5,937	7,625	6,354	56 - 72	106	150,000
	94L-30K8	11,058	8,671	11,137	9,280	82 - 105	106	150,000
	94L-30K9	7,571	5,937	7,625	6,354	56 - 72	106	150,000
	144L-50K7	18,370	14,405	18,502	15,416	89 - 114	162	125,000
	144L-40K7	18,324	14,369	18,456	15,377	89 - 114	162	125,000
	144L-40K8	17,166	13,461	17,289	14,405	83 - 107	162	125,000
	144L-35K8	16,427	12,882	16,545	13,785	80 - 102	162	125,000
	144L-35K9	11,247	8,820	11,328	9,438	54 - 70	162	125,000
	144L-30K8	16,427	12,882	16,545	13,785	80 - 102	162	125,000
	144L-30K9	11,247	8,820	11,328	9,438	54 - 70	162	125,000
	192L-50K7	24,005	18,824	24,178	20,145	90 - 116	209	105,000
	192L-40K7	23,945	18,777	24,117	20,094	90 - 115	209	105,000
	192L-40K8	22,431	17,590	22,592	18,824	84 - 108	209	105,000
	192L-35K8	21,466	16,833	21,620	18,014	81 - 103	209	105,000
	192L-35K9	14,697	11,525	14,802	12,334	55 - 71	209	105,000
	192L-30K8	21,466	16,833	21,620	18,014	81 - 103	209	105,000
	192L-30K9	14,697	11,525	14,802	12,334	55 - 71	209	105,000

Displayed information is for selected luminaires only. Information is subject to change without notice.
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L12A
L12B
L12C
L12D

Project		Catalog #		Type	
Prepared by		Notes		Date	



Metalux

SNLED Lensed

Lensed LED Strip Round and Square Lens

Typical Applications

Storage / Utility • Coves • Display Cases • Task and General Area

Interactive Menu

- Order Information page 2
- Photometric Data page 3
- Connected Systems page 3
- Product Warranty

Product Certification

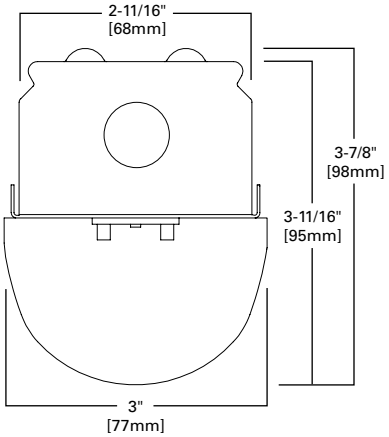
Product Features

Top Product Features

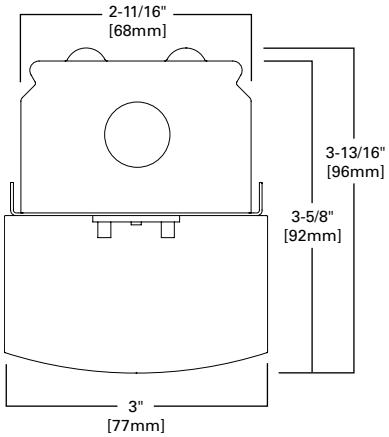
- Standard (SL) and High lumen/High Efficacy (HL) packages
- High efficiencies - up to 153 LPW
- Three different lens types for optical control
- Two different reflectors for precise distribution control
- Available CCT: 3000K, 3500K, 4000K and 5000K
- Minimum CRI of 80; 90 CRI available
- Options to meet Trade Agreements Act requirements

Dimensional Details

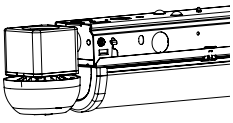
Round Lens



Square Lens



ZW-SWPD3 Sidecar



additional product diagrams

Order Information

SAMPLE ORDER NUMBER: **4SNLED-LD5-46SL-LN-UNV-L835-CD1-U**
8TSNLED-LD5-200HL-SLN-UNV-EL7W-L840-CD2-U

Domestic Preferences [19]	Length			Series	Lamp Type
[Blank]=Standard **TAA**=Trade Agreements Act	**2**=2 ft.	**4**=4 ft.	**8T**=8 ft.	**SNLED**=Commercial LED Striplight [1]	**LD5**=LED 5.0

See schedule

LED Lumen Packages [2]

2 ft. Round Lens

LC	LN	LW
18SL	18SL	16SL
22SL	22SL	20SL
26SL	26SL	23SL
34HL	32HL	30HL
Clear	Semi-frost narrow	Full frost wide

4 ft. Round Lens

LC	LN	LW
18SL	18SL	16SL
22SL	22SL	20SL
26SL	26SL	23SL
30SL	30SL	27SL
34SL	34SL	30SL
37SL	37SL	33SL
41SL	41SL	37SL
46SL	46SL	41SL
49SL	53SL	44SL
52SL	56SL	47SL
56SL	61SL	50SL
63SL	64SL	56SL
66SL	50HL	58SL
52HL	54HL	44HL
55HL	60HL	48HL
60HL	74HL	54HL
76HL		65HL
Clear	Semi-frost narrow	Full frost wide

8 ft. Round Lens

LC	LN	LW
60SL	60SL	54SL
68SL	68SL	61SL
75SL	75SL	67SL
83SL	83SL	74SL
90SL	91SL	81SL
98SL	98SL	88SL
105SL [3]	106SL	95SL
130HL [3]	130HL [3]	110HL
170HL [3]	170HL [3]	150HL
Clear	Semi-frost narrow	Full frost wide

SL denotes standard lumen output. HL denotes high lumen output. Additional LEDs to obtain lumen package.
For comparable lumen packages, HL efficacy is greater than SL efficacy.
26SL: 2600 delivered lumens, standard lumen output
170HL: 17000 delivered lumens, high output.

2 ft. Square Lens

SLC	SLN	SLW
19SL	19SL	16SL
24SL	24SL	20SL
27SL	27SL	22SL
37HL	37HL	30HL
48HL	48HL	41HL
Clear	Semi-frost narrow	Full frost wide

Same notes apply as round (column on left)

4 ft. Square Lens

SLC	SLN	SLW
19SL	19SL	15SL
23SL	23SL	19SL
27SL	27SL	22SL
30SL	30SL	25SL
35SL	35SL	29SL
39SL	39SL	32SL
42SL	42SL	35SL
47SL	46SL	39SL
50SL	50SL	41SL
54SL	54SL	45SL
58SL	58SL	48SL
63SL	63SL	52SL
65SL	65SL	54SL
77SL	78SL	64SL
85SL	85SL	70SL
54HL	54HL	46HL
57HL	57HL	48HL
62HL	62HL	52HL
68HL	68HL	57HL
82HL	82HL	69HL
97HL	97HL	81HL
Clear	Semi-frost narrow	Full frost wide

8 ft. Square Lens

SLC	SLN	SLW
60SL	64SL	50SL
70SL	70SL	58SL
78SL	77SL	64SL
84SL	84SL	70SL
93SL	93SL	77SL
100SL	100SL	83SL
108SL	108SL	90SL
116SL	116SL	96SL
125SL	125SL	104SL
131SL	130SL	108SL
130HL	130HL	130HL
170HL [3]	170HL [3]	170HL [3]
200HL	200HL	200HL
Clear	Semi-frost narrow	Full frost wide

Notes: (1) DesignLights Consortium® Qualified and classified for both DLC Standard and DLC Premium, refer to www.designlights.org for details. (2) Nominal lumen values. See table for value and fixture length. (3) DALI and Step-dim versions require two drivers. (4) 4 ft. and 8 ft. only. (5) 347V CD driver is limited to 50W max output before requiring 2 drivers (no 85W 347V solution). (6) 347 SD Driver require qty 2 transformers for Dual switch legs can not offer with EBP due to space requirements for 3 ed transformer for EBP charge circuit.(7) All other drivers at 347V requires single transformer for Driver. If EBP is included, would require second transformer THD an PF affected by transformer (no DLC). (8) 4 ft. and 8 ft. only. (9) Motion Sensor offers dimmability. (10) With integral test switch/ indicator/laser test. For approximate delivered lumens multiply the lumens per watt of the desired fixture by the wattage of the emergency battery pack (100 lm/W x 7=700 lumens). IES-format photometry for luminaire under emergency operation available. (11) Used to bypass local control during outage. Must be used in conjunction with UL 1008 device (provided by others). GTR2 and ETR2 options include 2 relays on fixtures with dimming drivers. ETRD option only requires one relay when used on a dimming fixture. Must specify voltage as 120V or 277V when ordering these devices. (12) Most common C&P shown. Must specify location for cord. All "end" locations will be on the end with sensor installed. (13) Consult tech support on numerous options for this feature. (14) Sensors provided in separate externally mounted enclosure. See SRL spec sheet for fully integrated/connected sensors. (15) 4 ft. and 8 ft. only. (16) For a complete listing of Fifth Light products, visit www.cooperlighting.com (17) Black fixture and lens ends. Refer to Finish multiplier table for performance (page 3). (18) Accessories sold separately will be separately analyzed under domestic preference requirements. Consult factory for further information. (19) Only product configurations with this designated prefix are built to be compliant with the Trade Agreements Act of 1979 (TAA). Please refer to DOMESTIC PREFERENCES website for more information. Components shipped separately may be separately analyzed under domestic preference requirements. (21) Emergency component is UL924 classified. (22) WLSx provided in separate enclosure. (23) Not available in Mid-Row Configuration.

Integrated options must be used in conjunction with the associated system and may not be compatible with other options or accessories. Please refer to the following: (A) Consult WaveLinx system pages for additional details and compatibility. (B) Consult WaveLinx Lite system pages for additional details and compatibility.

Order Information

SAMPLE ORDER NUMBER: **4SNLED-LD5-46SL-LN-UNV-L835-CD1-U**
8TSNLED-LD5-200HL-SLN-UNV-EL7W-L840-CD2-U

Lens	Voltage	Options			Color Temp / CCT
Round **LC**=Clear Lens **LN**=Semi-Frost Lens - Narrow **LW**=Full Frost Lens - Wide **Square** **SLC**=Square / Flat Clear Lens **SLN**=Square / Flat Semi - Frost Lens - Narrow **SLW**=Square / Flat Full Frost Lens - Wide	**UNV**=Universal Voltage 120-277 **347**=347V [5], [6], [7] **480**=480V [4]	**Emergency** **EL7W**=7-watt, 120V-277V emergency battery pack installed [8], [10], [21] **EL14W**=14-watt 120V-277V emergency battery pack installed [8], [10], [21] **GTR2**=Bodine Generator Transfer Relay [11] **ETRD**=Iota Emergency Transfer Relay with dimming control [11], [21]	**Wiring** **PI/CPI**=Plug in and cross over plug in options [13] **PC6/515P**=(NEMA 5-15P) 6 ft. Cord with NEMA Straight Plug [12], [13] **PC6/L715**=(NEMA L7-15P) 6 ft. Cord with NEMA Twist Plug [12], [13]	**Motion Sensors** [14] **LB-ERMS360**=360° Low Bay Motion Sensor - End of Row, 8' Mounting **LB-MRMS360**=360° Low Bay Motion Sensor - Middle of Row, 8' Mounting **HB-ERMS360**=360° High Bay Motion Sensor - End of Row, 15-40' Mounting [9] **HB-MRMS360**=360° High Bay Motion Sensor - Middle of Row, 15-40' Mounting [9] **WLS (formerly WAB)**=WaveLinx LITE Wireless Sensor, Occupancy w/ photocell, Independent & Networked [B] **WPS (formerly WAA)**=WaveLinx PRO Wireless Sensor, Occupancy w/ photocell, Networked [A] **WLS4**=WaveLinx LITE, Dimming Motion and Daylight, Bluetooth Programmable, 15' - 40' Mounting [22], [23], [B] **WPS4**=WaveLinx PRO, Dimming Motion and Daylight, WAC Programmable, 15' - 40' Mounting [A] **ZW-SWPD3**=Integrated Wavelinx Wireless Sensor, 1200 sqft. coverage [22], [23], [B]	**CCT/CRI** **L830**=3000K, 80 CRI **L835**=3500K, 80 CRI **L840**=4000K, 80 CRI **L850**=5000K, 80 CRI **L930**=3000K, 90 CRI **L935**=3500K, 90 CRI **L940**=4000K, 90 CRI **L950**=5000K, 90 CRI

Drive Type	No.of Drivers	Paint Finish	Packaging	Accessories (Order Separately) [18]		
CD=0-10V Dimming Driver (10%-100% Dimming) **HCD**=0-10V Dimming Driver (1%-100% Dimming) **SD**=Step-dim (Bi Level) [15] **5LTD**=Fifth Light (DALI) Driver [15], [16]	**1**=1 Driver **2**=2 Drivers	**[blank]**=Standard White **BLK**=PAF Black [17]	**U**=Unit Pack	**AYC-Chain/Set**=36" Chain Hanger (Use 1 set per fixture) **SCF**=Fixed Stem Set (Specify Length) **SCS**=Swivel Stem Set (Specify Length) **SCA**=Adjustable 48" Stem Set **EYE-CHAIN/SET-B**=Eye Bolt Chain (Use 1 set per fixture) **WG/SNF-2FT**=2 ft Wire Guard **WG/SNF-4FT**=4 ft Wire Guard **A1B/Spacer-U**=Spacer 1-1/2" to 2-1/2" from ceiling (Use 2 per fixture) **TOGGLE**=Single Toggle No. 2 (Specify Length) **Y-TOGGLE-__-2PK**=(2) Y-Toggle Cable Kits (Specify 10 or 30 for length in feet) **GRP-SNF-U**=Gripper Hanger **CLC-SNLED-EXT-B**=SNLED Long Row Aligner Extension	**Round Replacement Lenses** **SNLED-LENS-LW-2FT-U**= Replacement Lens 2 ft, Full Frost **SNLED-LENS-LN-2FT-U**= Replacement Lens 2 ft, Semi Frost **SNLED-LENS-LC-2FT-U**= Replacement Lens 2 ft, Clear **SNLED-LENS-LW-4FT-U**= Replacement Lens 4 ft, Full Frost **SNLED-LENS-LN-4FT-U**= Replacement Lens 4 ft, Semi Frost **SNLED-LENS-LC-4FT-U**= Replacement Lens 4 ft, Clear	**Square Replacement Lenses** **SNLED-SQLENS-SLW-2FT-U**= Replacement Lens 2 ft, Full Frost **SNLED-SQLENS-SLN-2FT-U**= Replacement Lens 2 ft, Semi Frost **SNLED-SQLENS-SLC-2FT-U**= Replacement Lens 2 ft, Clear **SNLED-SQLENS-SLW-4FT-U**= Replacement Lens 4 ft, Full Frost **SNLED-SQLENS-SLN-4FT-U**= Replacement Lens 4 ft, Semi Frost **SNLED-SQLENS-SLC-4FT-U**= Replacement Lens 4 ft, Clear

Notes: (1) DesignLights Consortium® Qualified and classified for both DLC Standard and DLC Premium, refer to www.designlights.org for details. (2) Nominal lumen values. See table for value and fixture length. (3) DALI and Step-dim versions require two drivers. (4) 4 ft. and 8 ft. only. (5) 347V CD driver is limited to 50W max output before requiring 2 drivers (no 85W 347V solution). (6) 347 SD Driver require qty 2 transformers for Dual switch legs can not offer with EBP due to space requirements for 3 ed transformer for EBP charge circuit.(7) All other drivers at 347V requires single transformer for Driver. If EBP is included, would require second transformer THD an PF affected by transformer (no DLC). (8) 4 ft. and 8 ft. only. (9) Motion Sensor offers dimmability. (10) With integral test switch/ indicator/laser test. For approximate delivered lumens multiply the lumens per watt of the desired fixture by the wattage of the emergency battery pack (100 lm/W x 7=700 lumens). IES-format photometry for luminaire under emergency operation available. (11) Used to bypass local control during outage. Must be used in conjunction with UL 1008 device (provided by others). GTR2 and ETR2 options include 2 relays on fixtures with dimming drivers. ETRD option only requires one relay when used on a dimming fixture. Must specify voltage as 120V or 277V when ordering these devices. (12) Most common C&P shown. Must specify location for cord. All "end" locations will be on the end with sensor installed. (13) Consult tech support on numerous options for this feature. (14) Sensors provided in separate externally mounted enclosure. See SRL spec sheet for fully integrated/connected sensors. (15) 4 ft. and 8 ft. only. (16) For a complete listing of Fifth Light products, visit www.cooperlighting.com (17) Black fixture and lens ends. Refer to Finish multiplier table for performance (page 3). (18) Accessories sold separately will be separately analyzed under domestic preference requirements. Consult factory for further information. (19) Only product configurations with this designated prefix are built to be compliant with the Trade Agreements Act of 1979 (TAA). Please refer to DOMESTIC PREFERENCES website for more information. Components shipped separately may be separately analyzed under domestic preference requirements. (20) WaveLinx Lite devices are not currently compatible with the WaveLinx Pro Wireless Area Controller. (21) Emergency component is UL924 classified.

Product Specifications

Construction
- Die-formed of cold rolled steel with numerous knockouts for easy installation
- Groove for Tong Hanger
- Convertible end plate for continuous row alignment
- Channel/wireway cover secured with sheet metal screws
- Surface, pendant or stem mounting

Controls
- Standard with 0-10V dimming driver (10% standard, 1% optional)
- Integrated WaveLinx sensor options provide wireless individual fixture control and enable code compliance, ncreased energy savings, grouping of fixtures, and connection to WaveLinx control systems
- DALI 2.0 and step-dimming available
- For motion control, reference sensor locations for both end and middle of the row applications

Electrical
- Long-life LED system with electrical driver for optimal performance
- LED's available in 3000K, 3500K, 4000K or 5000K with CRI of 80 standard or optional 90 CRI
- TM21 rating of L87>60,000 hours
- Electronic drivers available for 120-277V, 347V and 480 applications
- Operating temperatures of -20°C up to 50°C (refer to ambient temperature chart)

Emergency Battery Pack Option
- Optional 120V-277V integral emergency battery pack available in 7W or 14W
- 90-minute backup period for code compliance
- Generator transfer options available

Finish
- Multi-stage, iron phosphate pretreatment
- Highly reflective paint after fabrication
- Standard baked white enamel finish

Shielding
- Three round lensed optical distributions available: Clear with linear ribs (LC), semi-frost for narrow distribution (LN) and full frost for wide distribution (LW)
- Three square lensed optical distributions available: clear with linear ribs (SLC), semi-frost for narrow distribution (SLN) and full frost for wide distribution (SLW)

Compliance
- cULus Listed for damp locations
- State of California Title 24 high efficacy luminaire
- DesignLights Consortium® Qualified and classified for DLC Standard and DLC Premium (refer to www.designlights.org)
- Suitable for closet use when installed to NEC 410.16 spacings standards

Warranty
- Five year limited warranty

WaveLinx LITE devices are not currently compatible with the WaveLinx PRO Wireless Area Controller

Photometric Data

View IES files

Control Solutions

- WaveLinx LITE wireless
- WaveLinx PRO wireless
- WaveLinx CAT wired
- WaveLinx Wired

WaveLinx Digital Lighting Control Solutions

Energy and Performance Data

CCT Table

Approximate Color Temperature	Multiplier
2700K	.93
3000K	.98
3500K	1.0
4000K	1.02
5000K	1.02

CRI

Lumen multiplier (80CRI to 90CRI)			
3000K	3500K	4000K	5000K
0.805	0.840	0.846	0.901

Shipping Data

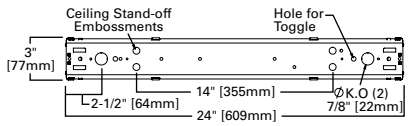
Length	Wt.
2 ft.	4.3 lbs.
4 ft.	8.2 lbs.
8 ft.	15.1 lbs.

Ambient Temperature

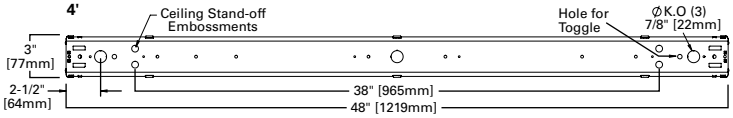
Length	Lumen Package	Standard	EM
2FT	16SL - 27SL	50°C	40°C
	30HL - 48HL	40°C	40°C
4FT	15SL - 54SL	50°C	40°C
	56SL - 97HL	40°C	40°C
8FT	50SL - 108SL	50°C	40°C
	110HL - 200HL	40°C	40°C

Dimensional and Mounting Details

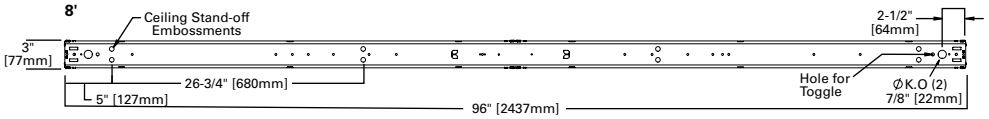
2'



4'



8'



Energy and Performance Data

Wattage: Round Clear Lens

SNELD Type	Lumen Type	Length	Catalog Number**	Nominal 3500K Lumens	Wattage	lm/W
Clear Lens (LC)	Standard	2 ft.	2SNLED-LD5-18SL-LC-UNV-L8XX-CD1-U	1960	14	137.4
Clear Lens (LC)	Standard	2 ft.	2SNLED-LD5-22SL-LC-UNV-L8XX-CD1-U	2420	18	133.7
Clear Lens (LC)	Standard	2 ft.	2SNLED-LD5-26SL-LC-UNV-L8XX-CD1-U	2747	21	131.1
Clear Lens (LC)	High	2 ft.	2SNLED-LD5-34HL-LC-UNV-L8XX-CD1-U	3487	27	131.2
Clear Lens (LC)	Standard	4 ft.	4SNLED-LD5-18SL-LC-UNV-L8XX-CD1-U	1890	13	145.0
Clear Lens (LC)	Standard	4 ft.	4SNLED-LD5-22SL-LC-UNV-L8XX-CD1-U	2344	16	146.4
Clear Lens (LC)	Standard	4 ft.	4SNLED-LD5-26SL-LC-UNV-L8XX-CD1-U	2699	18	146.3
Clear Lens (LC)	Standard	4 ft.	4SNLED-LD5-30SL-LC-UNV-L8XX-CD1-U	3077	21	145.4
Clear Lens (LC)	Standard	4 ft.	4SNLED-LD5-34SL-LC-UNV-L8XX-CD1-U	3567	25	143.3
Clear Lens (LC)	Standard	4 ft.	4SNLED-LD5-37SL-LC-UNV-L8XX-CD1-U	3924	28	141.6
Clear Lens (LC)	Standard	4 ft.	4SNLED-LD5-41SL-LC-UNV-L8XX-CD1-U	4269	31	139.6
Clear Lens (LC)	Standard	4 ft.	4SNLED-LD5-46SL-LC-UNV-L8XX-CD1-U	4718	35	136.8
Clear Lens (LC)	Standard	4 ft.	4SNLED-LD5-49SL-LC-UNV-L8XX-CD1-U	5051	38	134.4
Clear Lens (LC)	Standard	4 ft.	4SNLED-LD5-52SL-LC-UNV-L8XX-CD1-U	5478	41	133.3
Clear Lens (LC)	Standard	4 ft.	4SNLED-LD5-56SL-LC-UNV-L8XX-CD1-U	5880	46	127.4
Clear Lens (LC)	Standard	4 ft.	4SNLED-LD5-63SL-LC-UNV-L8XX-CD1-U	6358	52	123.1
Clear Lens (LC)	Standard	4 ft.	4SNLED-LD5-66SL-LC-UNV-L8XX-CD1-U	6628	55	120.2
Clear Lens (LC)	High	4 ft.	4SNLED-LD5-52HL-LC-UNV-L8XX-CD1-U	5171	37	139.5
Clear Lens (LC)	High	4 ft.	4SNLED-LD5-55HL-LC-UNV-L8XX-CD1-U	5409	39	138.5
Clear Lens (LC)	High	4 ft.	4SNLED-LD5-60HL-LC-UNV-L8XX-CD1-U	5893	43	136.7
Clear Lens (LC)	High	4 ft.	4SNLED-LD5-76HL-LC-UNV-L8XX-CD1-U	7774	62	125.1
Clear Lens (LC)	Standard	8 ft.	8TSNLED-LD5-60SL-LC-UNV-L8XX-CD1-U	6154	42	145.4
Clear Lens (LC)	Standard	8 ft.	8TSNLED-LD5-68SL-LC-UNV-L8XX-CD1-U	7134	50	143.3
Clear Lens (LC)	Standard	8 ft.	8TSNLED-LD5-75SL-LC-UNV-L8XX-CD1-U	7847	55	141.6
Clear Lens (LC)	Standard	8 ft.	8TSNLED-LD5-83SL-LC-UNV-L8XX-CD1-U	8537	61	139.6
Clear Lens (LC)	Standard	8 ft.	8TSNLED-LD5-90SL-LC-UNV-L8XX-CD1-U	9437	69	136.8
Clear Lens (LC)	Standard	8 ft.	8TSNLED-LD5-98SL-LC-UNV-L8XX-CD1-U	10101	75	134.4
Clear Lens (LC)	Standard	8 ft.	8TSNLED-LD5-105SL-LC-UNV-L8XX-CD1-U	10956	82	133.3
Clear Lens (LC)	High	8 ft.	8TSNLED-LD5-130HL-LC-UNV-L8XX-CD2-U	11786	86	136.7
Clear Lens (LC)	High	8 ft.	8TSNLED-LD5-170HL-LC-UNV-L8XX-CD2-U	15549	124	125.1

* Consult factory for stock availability. ** Lumen portion of catalog number may not match actual lumens.

Energy and Performance Data

Wattage: Round Semi-frost Lens, Narrow

SNELD Type	Lumen Type	Length	Catalog Number**	Nominal 3500K Lumens	Wattage	lm/W
Semi-Frost Lens (LN)	Standard	2 ft.	2SNLED-LD5-18SL-LN-UNV-L8XX-CD1-U	1903	14	133.4
Semi-Frost Lens (LN)	Standard	2 ft.	2SNLED-LD5-22SL-LN-UNV-L8XX-CD1-U	2350	18	129.8
Semi-Frost Lens (LN)	Standard	2 ft.	2SNLED-LD5-26SL-LN-UNV-L8XX-CD1-U	2667	21	127.3
Semi-Frost Lens (LN)	High	2 ft.	2SNLED-LD5-32HL-LN-UNV-L8XX-CD1-U	3385	27	127.4
Semi-Frost Lens (LN)	Standard	4 ft.	4SNLED-LD5-18SL-LN-UNV-L8XX-CD1-U	1835	13	140.8
Semi-Frost Lens (LN)	Standard	4 ft.	4SNLED-LD5-22SL-LN-UNV-L8XX-CD1-U	2276	16	142.2
Semi-Frost Lens (LN)	Standard	4 ft.	4SNLED-LD5-26SL-LN-UNV-L8XX-CD1-U	2620	18	142.0
Semi-Frost Lens (LN)	Standard	4 ft.	4SNLED-LD5-30SL-LN-UNV-L8XX-CD1-U	2987	21	141.2
Semi-Frost Lens (LN)	Standard	4 ft.	4SNLED-LD5-34SL-LN-UNV-L8XX-CD1-U	3463	25	139.2
Semi-Frost Lens (LN)	Standard	4 ft.	4SNLED-LD5-37SL-LN-UNV-L8XX-CD1-U	3809	28	137.5
Semi-Frost Lens (LN)	Standard	4 ft.	4SNLED-LD5-41SL-LN-UNV-L8XX-CD1-U	4144	31	135.6
Semi-Frost Lens (LN)	Standard	4 ft.	4SNLED-LD5-46SL-LN-UNV-L8XX-CD1-U	4581	35	132.8
Semi-Frost Lens (LN)	Standard	4 ft.	4SNLED-LD5-49SL-LN-UNV-L8XX-CD1-U	4903	38	130.4
Semi-Frost Lens (LN)	Standard	4 ft.	4SNLED-LD5-53SL-LN-UNV-L8XX-CD1-U	5318	41	129.4
Semi-Frost Lens (LN)	Standard	4 ft.	4SNLED-LD5-56SL-LN-UNV-L8XX-CD1-U	5708	46	123.7
Semi-Frost Lens (LN)	Standard	4 ft.	4SNLED-LD5-61SL-LN-UNV-L8XX-CD1-U	6172	52	119.5
Semi-Frost Lens (LN)	Standard	4 ft.	4SNLED-LD5-64SL-LN-UNV-L8XX-CD1-U	6435	55	116.7
Semi-Frost Lens (LN)	High	4 ft.	4SNLED-LD5-50HL-LN-UNV-L8XX-CD1-U	5020	37	135.4
Semi-Frost Lens (LN)	High	4 ft.	4SNLED-LD5-54HL-LN-UNV-L8XX-CD1-U	5252	39	134.5
Semi-Frost Lens (LN)	High	4 ft.	4SNLED-LD5-60HL-LN-UNV-L8XX-CD1-U	5721	43	132.7
Semi-Frost Lens (LN)	High	4 ft.	4SNLED-LD5-74HL-LN-UNV-L8XX-CD1-U	7548	62	121.5
Semi-Frost Lens (LN)	Standard	8 ft.	8TSNLED-LD5-60SL-LN-UNV-L8XX-CD1-U	5975	42	141.2
Semi-Frost Lens (LN)	Standard	8 ft.	8TSNLED-LD5-68SL-LN-UNV-L8XX-CD1-U	6926	50	139.2
Semi-Frost Lens (LN)	Standard	8 ft.	8TSNLED-LD5-75SL-LN-UNV-L8XX-CD1-U	7619	55	137.5
Semi-Frost Lens (LN)	Standard	8 ft.	8TSNLED-LD5-83SL-LN-UNV-L8XX-CD1-U	8289	61	135.6
Semi-Frost Lens (LN)	Standard	8 ft.	8TSNLED-LD5-91SL-LN-UNV-L8XX-CD1-U	9162	69	132.8
Semi-Frost Lens (LN)	Standard	8 ft.	8TSNLED-LD5-98SL-LN-UNV-L8XX-CD1-U	9807	75	130.4
Semi-Frost Lens (LN)	Standard	8 ft.	8TSNLED-LD5-106SL-LN-UNV-L8XX-CD1-U	10636	82	129.4
Semi-Frost Lens (LN)	High	8 ft.	8TSNLED-LD5-130HL-LN-UNV-L8XX-CD2-U	11442	86	132.7
Semi-Frost Lens (LN)	High	8 ft.	8TSNLED-LD5-170HL-LN-UNV-L8XX-CD2-U	15095	124	121.5

* Consult factory for stock availability. ** Lumen portion of catalog number may not match actual lumens.

Energy and Performance Data

Wattage: Round Full-frost Lens, Wide

SNELD Type	Lumen Type	Length	Catalog Number**	Nominal 3500K Lumens	Wattage	lm/W
Full Frost Lens (LW)	Standard	2 ft.	2SNLED-LD5-16SL-LW-UNV-L8XX-CD1-U	1750	14	122.7
Full Frost Lens (LW)	Standard	2 ft.	2SNLED-LD5-20SL-LW-UNV-L8XX-CD1-U	2162	18	119.4
Full Frost Lens (LW)	Standard	2 ft.	2SNLED-LD5-23SL-LW-UNV-L8XX-CD1-U	2453	21	117.1
Full Frost Lens (LW)	High	2 ft.	2SNLED-LD5-30HL-LW-UNV-L8XX-CD1-U	2975	27	112.0
Full Frost Lens (LW)	Standard	4 ft.	4SNLED-LD5-16SL-LW-UNV-L8XX-CD1-U	1688	13	129.5
Full Frost Lens (LW)	Standard	4 ft.	4SNLED-LD5-20SL-LW-UNV-L8XX-CD1-U	2093	16	130.8
Full Frost Lens (LW)	Standard	4 ft.	4SNLED-LD5-23SL-LW-UNV-L8XX-CD1-U	2410	18	130.7
Full Frost Lens (LW)	Standard	4 ft.	4SNLED-LD5-27SL-LW-UNV-L8XX-CD1-U	2748	21	129.8
Full Frost Lens (LW)	Standard	4 ft.	4SNLED-LD5-30SL-LW-UNV-L8XX-CD1-U	3186	25	128.0
Full Frost Lens (LW)	Standard	4 ft.	4SNLED-LD5-33SL-LW-UNV-L8XX-CD1-U	3504	28	126.5
Full Frost Lens (LW)	Standard	4 ft.	4SNLED-LD5-37SL-LW-UNV-L8XX-CD1-U	3812	31	124.7
Full Frost Lens (LW)	Standard	4 ft.	4SNLED-LD5-41SL-LW-UNV-L8XX-CD1-U	4214	35	122.1
Full Frost Lens (LW)	Standard	4 ft.	4SNLED-LD5-44SL-LW-UNV-L8XX-CD1-U	4511	38	120.0
Full Frost Lens (LW)	Standard	4 ft.	4SNLED-LD5-47SL-LW-UNV-L8XX-CD1-U	4892	41	119.1
Full Frost Lens (LW)	Standard	4 ft.	4SNLED-LD5-50SL-LW-UNV-L8XX-CD1-U	5251	46	113.8
Full Frost Lens (LW)	Standard	4 ft.	4SNLED-LD5-56SL-LW-UNV-L8XX-CD1-U	5678	52	109.9
Full Frost Lens (LW)	Standard	4 ft.	4SNLED-LD5-58SL-LW-UNV-L8XX-CD1-U	5920	55	107.3
Full Frost Lens (LW)	High	4 ft.	4SNLED-LD5-44HL-LW-UNV-L8XX-CD1-U	4412	37	119.0
Full Frost Lens (LW)	High	4 ft.	4SNLED-LD5-48HL-LW-UNV-L8XX-CD1-U	4615	39	118.2
Full Frost Lens (LW)	High	4 ft.	4SNLED-LD5-54HL-LW-UNV-L8XX-CD1-U	5028	43	116.6
Full Frost Lens (LW)	High	4 ft.	4SNLED-LD5-65HL-LW-UNV-L8XX-CD1-U	6633	62	106.7
Full Frost Lens (LW)	Standard	8 ft.	8TSNLED-LD5-54SL-LW-UNV-L8XX-CD1-U	5496	42	129.8
Full Frost Lens (LW)	Standard	8 ft.	8TSNLED-LD5-61SL-LW-UNV-L8XX-CD1-U	6371	50	128.0
Full Frost Lens (LW)	Standard	8 ft.	8TSNLED-LD5-67SL-LW-UNV-L8XX-CD1-U	6371	50	128.0
Full Frost Lens (LW)	Standard	8 ft.	8TSNLED-LD5-74SL-LW-UNV-L8XX-CD1-U	7625	61	124.7
Full Frost Lens (LW)	Standard	8 ft.	8TSNLED-LD5-81SL-LW-UNV-L8XX-CD1-U	8428	69	122.1
Full Frost Lens (LW)	Standard	8 ft.	8TSNLED-LD5-88SL-LW-UNV-L8XX-CD1-U	9022	75	120.0
Full Frost Lens (LW)	Standard	8 ft.	8TSNLED-LD5-95SL-LW-UNV-L8XX-CD1-U	9785	82	119.1
Full Frost Lens (LW)	High	8 ft.	8TSNLED-LD5-110HL-LW-UNV-L8XX-CD1-U	11356	103	109.9
Full Frost Lens (LW)	High	8 ft.	8TSNLED-LD5-150HL-LW-UNV-L8XX-CD2-U	15739	158	99.5

* Consult factory for stock availability. ** Lumen portion of catalog number may not match actual lumens.

Energy and Performance Data

Wattage: Square Flat Clear Lens

SNELD Type	Lumen Type	Length	Catalog Number**	Nominal 3500K Lumens	Wattage	lm/W
Flat Clear Lens (SLC)	Standard	2 ft.	2SNLED-LD5-19SL-SLC-UNV-L8XX-CD1-U	1936	14	135.7
Flat Clear Lens (SLC)	Standard	2 ft.	2SNLED-LD5-24SL-SLC-UNV-L8XX-CD1-U	2391	18	132.1
Flat Clear Lens (SLC)	Standard	2 ft.	2SNLED-LD5-27SL-SLC-UNV-L8XX-CD1-U	2714	21	129.5
Flat Clear Lens (SLC)	High	2 ft.	2SNLED-LD5-37HL-SLC-UNV-L8XX-CD1-U	3669	27	138.1
Flat Clear Lens (SLC)	High	2 ft.	2SNLED-LD5-48HL-SLC-UNV-L8XX-CD1-U	4830	36	134.5
Flat Clear Lens (SLC)	Standard	4 ft.	4SNLED-LD5-19SL-SLC-UNV-L8XX-CD1-U	1868	13	143.3
Flat Clear Lens (SLC)	Standard	4 ft.	4SNLED-LD5-23SL-SLC-UNV-L8XX-CD1-U	2316	16	144.7
Flat Clear Lens (SLC)	Standard	4 ft.	4SNLED-LD5-27SL-SLC-UNV-L8XX-CD1-U	2666	18	144.5
Flat Clear Lens (SLC)	Standard	4 ft.	4SNLED-LD5-30SL-SLC-UNV-L8XX-CD1-U	3040	21	143.6
Flat Clear Lens (SLC)	Standard	4 ft.	4SNLED-LD5-35SL-SLC-UNV-L8XX-CD1-U	3524	25	141.6
Flat Clear Lens (SLC)	Standard	4 ft.	4SNLED-LD5-39SL-SLC-UNV-L8XX-CD1-U	3876	28	139.9
Flat Clear Lens (SLC)	Standard	4 ft.	4SNLED-LD5-42SL-SLC-UNV-L8XX-CD1-U	4217	31	138.0
Flat Clear Lens (SLC)	Standard	4 ft.	4SNLED-LD5-47SL-SLC-UNV-L8XX-CD1-U	4662	35	135.1
Flat Clear Lens (SLC)	Standard	4 ft.	4SNLED-LD5-50SL-SLC-UNV-L8XX-CD1-U	4990	38	132.7
Flat Clear Lens (SLC)	Standard	4 ft.	4SNLED-LD5-54SL-SLC-UNV-L8XX-CD1-U	5412	41	131.7
Flat Clear Lens (SLC)	Standard	4 ft.	4SNLED-LD5-58SL-SLC-UNV-L8XX-CD1-U	5809	46	125.9
Flat Clear Lens (SLC)	Standard	4 ft.	4SNLED-LD5-63SL-SLC-UNV-L8XX-CD1-U	6281	52	121.6
Flat Clear Lens (SLC)	Standard	4 ft.	4SNLED-LD5-65SL-SLC-UNV-L8XX-CD1-U	6549	55	118.7
Flat Clear Lens (SLC)	Standard	4 ft.	4SNLED-LD5-77SL-SLC-UNV-L8XX-CD1-U	7697	70	110.0
Flat Clear Lens (SLC)	Standard	4 ft.	4SNLED-LD5-85SL-SLC-UNV-L8XX-CD1-U	8490	85	100.4
Flat Clear Lens (SLC)	High	4 ft.	4SNLED-LD5-54HL-SLC-UNV-L8XX-CD1-U	5441	37	146.8
Flat Clear Lens (SLC)	High	4 ft.	4SNLED-LD5-57HL-SLC-UNV-L8XX-CD1-U	5692	39	145.7
Flat Clear Lens (SLC)	High	4 ft.	4SNLED-LD5-62HL-SLC-UNV-L8XX-CD1-U	6201	43	143.8
Flat Clear Lens (SLC)	High	4 ft.	4SNLED-LD5-68HL-SLC-UNV-L8XX-CD1-U	6795	48	140.8
Flat Clear Lens (SLC)	High	4 ft.	4SNLED-LD5-82HL-SLC-UNV-L8XX-CD1-U	8181	62	131.7
Flat Clear Lens (SLC)	High	4 ft.	4SNLED-LD5-97HL-SLC-UNV-L8XX-CD1-U	9705	79	122.7
Flat Clear Lens (SLC)	Standard	8 ft.	8TSNLED-LD5-60SL-SLC-UNV-L8XX-CD1-U	6080	42	143.6
Flat Clear Lens (SLC)	Standard	8 ft.	8TSNLED-LD5-70SL-SLC-UNV-L8XX-CD1-U	7048	50	141.6
Flat Clear Lens (SLC)	Standard	8 ft.	8TSNLED-LD5-78SL-SLC-UNV-L8XX-CD1-U	7753	50	139.9
Flat Clear Lens (SLC)	Standard	8 ft.	8TSNLED-LD5-84SL-SLC-UNV-L8XX-CD1-U	8435	61	138.0
Flat Clear Lens (SLC)	Standard	8 ft.	8TSNLED-LD5-93SL-SLC-UNV-L8XX-CD1-U	9323	69	135.1
Flat Clear Lens (SLC)	Standard	8 ft.	8TSNLED-LD5-100SL-SLC-UNV-L8XX-CD1-U	9980	75	132.7
Flat Clear Lens (SLC)	Standard	8 ft.	8TSNLED-LD5-108SL-SLC-UNV-L8XX-CD1-U	10824	82	131.7
Flat Clear Lens (SLC)	Standard	8 ft.	8TSNLED-LD5-116SL-SLC-UNV-L8XX-CD1-U	11618	61	125.9
Flat Clear Lens (SLC)	Standard	8 ft.	8TSNLED-LD5-125SL-SLC-UNV-L8XX-CD2-U	12562	69	121.6
Flat Clear Lens (SLC)	Standard	8 ft.	8TSNLED-LD5-131SL-SLC-UNV-L8XX-CD2-U	13097	75	118.7
Flat Clear Lens (SLC)	High	8 ft.	8TSNLED-LD5-130HL-SLC-UNV-L8XX-CD2-U	12402	82	143.8
Flat Clear Lens (SLC)	High	8 ft.	8TSNLED-LD5-170HL-SLC-UNV-L8XX-CD2-U	16361	103	131.7
Flat Clear Lens (SLC)	High	8 ft.	8TSNLED-LD5-200HL-SLC-UNV-L8XX-CD2-U	19411	158	122.7

* Consult factory for stock availability. ** Lumen portion of catalog number may not match actual lumens.

Energy and Performance Data

Wattage: Square Flat Semi-frost Lens, Narrow

SNELD Type	Lumen Type	Length	Catalog Number**	Nominal 3500K Lumens	Wattage	lm/W
Flat Semi-frost Lens (SLN)	Standard	2 ft.	2SNLED-LD5-19SL-SLN-UNV-L8XX-CD1-U	1931	14	135.3
Flat Semi-frost Lens (SLN)	Standard	2 ft.	2SNLED-LD5-24SL-SLN-UNV-L8XX-CD1-U	2385	18	131.7
Flat Semi-frost Lens (SLN)	Standard	2 ft.	2SNLED-LD5-27SL-SLN-UNV-L8XX-CD1-U	2706	21	129.1
Flat Semi-frost Lens (SLN)	High	2 ft.	2SNLED-LD5-37HL-SLN-UNV-L8XX-CD1-U	3659	27	137.7
Flat Semi-frost Lens (SLN)	High	2 ft.	2SNLED-LD5-48HL-SLN-UNV-L8XX-CD1-U	4816	36	134.2
Flat Semi-frost Lens (SLN)	Standard	4 ft.	4SNLED-LD5-19SL-SLN-UNV-L8XX-CD1-U	1863	13	142.9
Flat Semi-frost Lens (SLN)	Standard	4 ft.	4SNLED-LD5-23SL-SLN-UNV-L8XX-CD1-U	2309	16	144.3
Flat Semi-frost Lens (SLN)	Standard	4 ft.	4SNLED-LD5-27SL-SLN-UNV-L8XX-CD1-U	2659	18	144.1
Flat Semi-frost Lens (SLN)	Standard	4 ft.	4SNLED-LD5-30SL-SLN-UNV-L8XX-CD1-U	3032	21	143.2
Flat Semi-frost Lens (SLN)	Standard	4 ft.	4SNLED-LD5-35SL-SLN-UNV-L8XX-CD1-U	3514	25	141.2
Flat Semi-frost Lens (SLN)	Standard	4 ft.	4SNLED-LD5-39SL-SLN-UNV-L8XX-CD1-U	3866	28	139.5
Flat Semi-frost Lens (SLN)	Standard	4 ft.	4SNLED-LD5-42SL-SLN-UNV-L8XX-CD1-U	4206	31	137.6
Flat Semi-frost Lens (SLN)	Standard	4 ft.	4SNLED-LD5-46SL-SLN-UNV-L8XX-CD1-U	4649	35	134.7
Flat Semi-frost Lens (SLN)	Standard	4 ft.	4SNLED-LD5-50SL-SLN-UNV-L8XX-CD1-U	4976	38	132.4
Flat Semi-frost Lens (SLN)	Standard	4 ft.	4SNLED-LD5-54SL-SLN-UNV-L8XX-CD1-U	5397	41	131.4
Flat Semi-frost Lens (SLN)	Standard	4 ft.	4SNLED-LD5-58SL-SLN-UNV-L8XX-CD1-U	5793	46	125.6
Flat Semi-frost Lens (SLN)	Standard	4 ft.	4SNLED-LD5-63SL-SLN-UNV-L8XX-CD1-U	6264	52	121.3
Flat Semi-frost Lens (SLN)	Standard	4 ft.	4SNLED-LD5-65SL-SLN-UNV-L8XX-CD1-U	6530	55	118.4
Flat Semi-frost Lens (SLN)	Standard	4 ft.	4SNLED-LD5-78SL-SLN-UNV-L8XX-CD1-U	7676	70	109.7
Flat Semi-frost Lens (SLN)	Standard	4 ft.	4SNLED-LD5-85SL-SLN-UNV-L8XX-CD1-U	8466	85	100.1
Flat Semi-frost Lens (SLN)	High	4 ft.	4SNLED-LD5-54HL-SLN-UNV-L8XX-CD1-U	5426	37	146.4
Flat Semi-frost Lens (SLN)	High	4 ft.	4SNLED-LD5-57HL-SLN-UNV-L8XX-CD1-U	5676	39	145.3
Flat Semi-frost Lens (SLN)	High	4 ft.	4SNLED-LD5-62HL-SLN-UNV-L8XX-CD1-U	6184	43	143.4
Flat Semi-frost Lens (SLN)	High	4 ft.	4SNLED-LD5-68HL-SLN-UNV-L8XX-CD1-U	6776	48	140.5
Flat Semi-frost Lens (SLN)	High	4 ft.	4SNLED-LD5-82HL-SLN-UNV-L8XX-CD1-U	8158	62	131.3
Flat Semi-frost Lens (SLN)	High	4 ft.	4SNLED-LD5-97HL-SLN-UNV-L8XX-CD1-U	9679	79	122.4
Flat Semi-frost Lens (SLN)	Standard	8 ft.	8TSNLED-LD5-64SL-SLN-UNV-L8XX-CD1-U	6063	42	143.2
Flat Semi-frost Lens (SLN)	Standard	8 ft.	8TSNLED-LD5-70SL-SLN-UNV-L8XX-CD1-U	7028	50	141.2
Flat Semi-frost Lens (SLN)	Standard	8 ft.	8TSNLED-LD5-77SL-SLN-UNV-L8XX-CD1-U	7731	55	139.5
Flat Semi-frost Lens (SLN)	Standard	8 ft.	8TSNLED-LD5-84SL-SLN-UNV-L8XX-CD1-U	8411	61	137.6
Flat Semi-frost Lens (SLN)	Standard	8 ft.	8TSNLED-LD5-93SL-SLN-UNV-L8XX-CD1-U	9297	69	134.7
Flat Semi-frost Lens (SLN)	Standard	8 ft.	8TSNLED-LD5-100SL-SLN-UNV-L8XX-CD1-U	9952	75	132.4
Flat Semi-frost Lens (SLN)	Standard	8 ft.	8TSNLED-LD5-108SL-SLN-UNV-L8XX-CD1-U	10794	82	131.4
Flat Semi-frost Lens (SLN)	Standard	8 ft.	8TSNLED-LD5-116SL-SLN-UNV-L8XX-CD1-U	11586	92	125.6
Flat Semi-frost Lens (SLN)	Standard	8 ft.	8TSNLED-LD5-125SL-SLN-UNV-L8XX-CD2-U	12527	103	121.3
Flat Semi-frost Lens (SLN)	Standard	8 ft.	8TSNLED-LD5-130SL-SLN-UNV-L8XX-CD2-U	13061	110	118.4
Flat Semi-frost Lens (SLN)	High	8 ft.	8TSNLED-LD5-130HL-SLN-UNV-L8XX-CD2-U	12368	86	143.4
Flat Semi-frost Lens (SLN)	High	8 ft.	8TSNLED-LD5-170HL-SLN-UNV-L8XX-CD2-U	16316	124	131.3
Flat Semi-frost Lens (SLN)	High	8 ft.	8TSNLED-LD5-200HL-SLN-UNV-L8XX-CD2-U	19357	158	122.4

* Consult factory for stock availability. ** Lumen portion of catalog number may not match actual lumens.

Energy and Performance Data

Wattage: Square Flat Full-frost Lens, Wide

SNELD Type	Lumen Type	Length	Catalog Number**	Nominal 3500K Lumens	Wattage	lm/W
Flat Full-frost Lens (SLW)	Standard	2 ft.	2SNLED-LD5-16SL-SLW-UNV-L8XX-CD1-U	1604	14	112.4
Flat Full-frost Lens (SLW)	Standard	2 ft.	2SNLED-LD5-20SL-SLW-UNV-L8XX-CD1-U	1981	18	109.4
Flat Full-frost Lens (SLW)	Standard	2 ft.	2SNLED-LD5-22SL-SLW-UNV-L8XX-CD1-U	2248	21	107.3
Flat Full-frost Lens (SLW)	High	2 ft.	2SNLED-LD5-30HL-SLW-UNV-L8XX-CD1-U	3077	27	115.8
Flat Full-frost Lens (SLW)	High	2 ft.	2SNLED-LD5-41HL-SLW-UNV-L8XX-CD1-U	4051	36	
Flat Full-frost Lens (SLW)	Standard	4 ft.	4SNLED-LD5-15SL-SLW-UNV-L8XX-CD1-U	1547	13	118.7
Flat Full-frost Lens (SLW)	Standard	4 ft.	4SNLED-LD5-19SL-SLW-UNV-L8XX-CD1-U	1918	16	119.8
Flat Full-frost Lens (SLW)	Standard	4 ft.	4SNLED-LD5-22SL-SLW-UNV-L8XX-CD1-U	2209	18	119.7
Flat Full-frost Lens (SLW)	Standard	4 ft.	4SNLED-LD5-25SL-SLW-UNV-L8XX-CD1-U	2518	21	119.0
Flat Full-frost Lens (SLW)	Standard	4 ft.	4SNLED-LD5-29SL-SLW-UNV-L8XX-CD1-U	2919	25	117.3
Flat Full-frost Lens (SLW)	Standard	4 ft.	4SNLED-LD5-32SL-SLW-UNV-L8XX-CD1-U	3211	28	115.9
Flat Full-frost Lens (SLW)	Standard	4 ft.	4SNLED-LD5-35SL-SLW-UNV-L8XX-CD1-U	3494	31	114.3
Flat Full-frost Lens (SLW)	Standard	4 ft.	4SNLED-LD5-39SL-SLW-UNV-L8XX-CD1-U	3862	35	111.9
Flat Full-frost Lens (SLW)	Standard	4 ft.	4SNLED-LD5-41SL-SLW-UNV-L8XX-CD1-U	4134	38	110.0
Flat Full-frost Lens (SLW)	Standard	4 ft.	4SNLED-LD5-45SL-SLW-UNV-L8XX-CD1-U	4483	41	109.1
Flat Full-frost Lens (SLW)	Standard	4 ft.	4SNLED-LD5-48SL-SLW-UNV-L8XX-CD1-U	4812	46	104.3
Flat Full-frost Lens (SLW)	Standard	4 ft.	4SNLED-LD5-52SL-SLW-UNV-L8XX-CD1-U	5203	52	100.7
Flat Full-frost Lens (SLW)	Standard	4 ft.	4SNLED-LD5-54SL-SLW-UNV-L8XX-CD1-U	5425	55	98.4
Flat Full-frost Lens (SLW)	Standard	4 ft.	4SNLED-LD5-64SL-SLW-UNV-L8XX-CD1-U	6376	70	91.1
Flat Full-frost Lens (SLW)	Standard	4 ft.	4SNLED-LD5-70SL-SLW-UNV-L8XX-CD1-U	7033	48	83.1
Flat Full-frost Lens (SLW)	High	4 ft.	4SNLED-LD5-46HL-SLW-UNV-L8XX-CD1-U	4564	37	123.1
Flat Full-frost Lens (SLW)	High	4 ft.	4SNLED-LD5-48HL-SLW-UNV-L8XX-CD1-U	4774	39	122.2
Flat Full-frost Lens (SLW)	High	4 ft.	4SNLED-LD5-52HL-SLW-UNV-L8XX-CD1-U	5201	43	120.6
Flat Full-frost Lens (SLW)	High	4 ft.	4SNLED-LD5-57HL-SLW-UNV-L8XX-CD1-U	5699	48	118.1
Flat Full-frost Lens (SLW)	High	4 ft.	4SNLED-LD5-69HL-SLW-UNV-L8XX-CD1-U	6862	62	110.4
Flat Full-frost Lens (SLW)	High	4 ft.	4SNLED-LD5-81HL-SLW-UNV-L8XX-CD1-U	8141	79	102.9
Flat Full-frost Lens (SLW)	Standard	8 ft.	8TSNLED-LD5-50SL-SLW-UNV-L8XX-CD1-U	5037	42	119.0
Flat Full-frost Lens (SLW)	Standard	8 ft.	8TSNLED-LD5-58SL-SLW-UNV-L8XX-CD1-U	5838	50	117.3
Flat Full-frost Lens (SLW)	Standard	8 ft.	8TSNLED-LD5-64SL-SLW-UNV-L8XX-CD1-U	6422	55	115.9
Flat Full-frost Lens (SLW)	Standard	8 ft.	8TSNLED-LD5-70SL-SLW-UNV-L8XX-CD1-U	6987	61	114.3
Flat Full-frost Lens (SLW)	Standard	8 ft.	8TSNLED-LD5-77SL-SLW-UNV-L8XX-CD1-U	7723	69	111.9
Flat Full-frost Lens (SLW)	Standard	8 ft.	8TSNLED-LD5-83SL-SLW-UNV-L8XX-CD1-U	8267	75	110.0
Flat Full-frost Lens (SLW)	Standard	8 ft.	8TSNLED-LD5-90SL-SLW-UNV-L8XX-CD1-U	8966	82	109.1
Flat Full-frost Lens (SLW)	Standard	8 ft.	8TSNLED-LD5-96SL-SLW-UNV-L8XX-CD1-U	9624	92	104.3
Flat Full-frost Lens (SLW)	Standard	8 ft.	8TSNLED-LD5-104SL-SLW-UNV-L8XX-CD1-U	10406	103	100.7
Flat Full-frost Lens (SLW)	Standard	8 ft.	8TSNLED-LD5-108SL-SLW-UNV-L8XX-CD1-U	10850	110	98.4
Flat Full-frost Lens (SLW)	High	8 ft.	8TSNLED-LD5-130HL-SLW-UNV-L8XX-CD2-U	10402	86	120.6
Flat Full-frost Lens (SLW)	High	8 ft.	8TSNLED-LD5-170HL-SLW-UNV-L8XX-CD2-U	13723	124	110.4
Flat Full-frost Lens (SLW)	High	8 ft.	8TSNLED-LD5-200HL-SLW-UNV-L8XX-CD2-U	16281	158	102.9

* Consult factory for stock availability. ** Lumen portion of catalog number may not match actual lumens.

Cooper Lighting Solutions
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www.cooperlighting.com

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Specifications and dimensions subject to change without notice.

CYLINDER 10x18

architectural

LED 8" aperture open 1100 to 3000 lumens

Project: L13

Type:

Catalog number:

LED cylinder | 120-277 Volt

Textured polyester powdercoat on exterior finish available in black, white, bronze or metallic silver. Other finishes available consult factory.

Pendant fixtures feature a 5/8" OD mounting stem with a swivel canopy that self-adjusts up to 45° to accommodate slope ceilings. Factory standard stem length is 12". Pendant mount for indoor applications only.

Cord mount fixtures have a standard 6-foot black power cord. White cord supplied on white fixtures only. L – Factory standard cord length is 6 feet, field adjustable to shorter lengths. Dimming not available with coil cord options.

Wall mount fixtures have a cast aluminum mounting arm that is 4 5/8"W x 4 7/8"H.

RLEM - IOTA ILB-CP or equivalent. Factory wired with quick-connect leads that will position pack 3-ft. from cylinder max. Contact factory for longer lengths. Not available on cord mount.

PrevaLED® by eldoLED Cube LED Module

- Superior quality white LED light
- 80+ CRI
- Rated Life: 50,000 hours at 70% lumen maintenance (L70) when maintained in a 40°C ambient environment with open air flow. Ambient temperatures lower than 40°C may extend life of module. 5-year warranty.

OPTOTRONIC® by eldoLED Driver

- Dimmable, instant 100% light (1%-100%) via: 0-10V protocol. 5-year warranty.

Passive Heat Sink

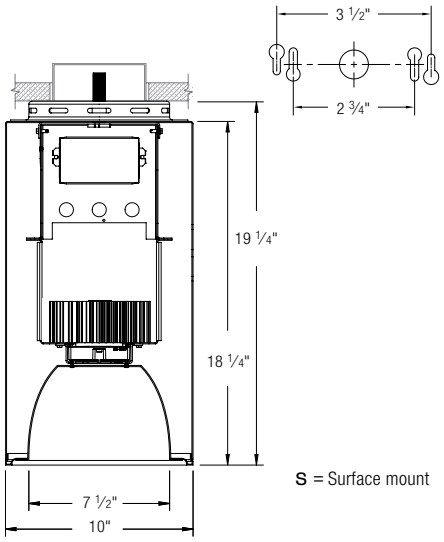
- Black anodized aluminum

Listed to UL 1598 and Canadian standards for Damp Location. Intended for indoor applications only. ENERGY STAR® qualified (120V/277V and with standard driver only). Available photometrics at atlantic-lighting.com.

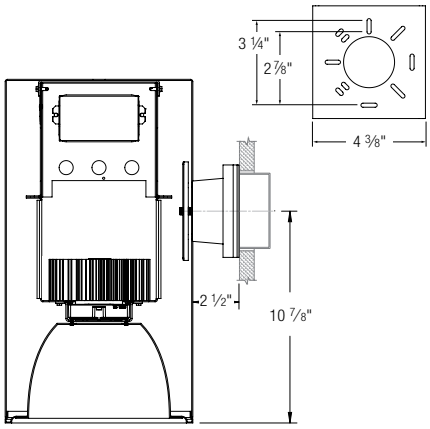
Fixture complies with ARRA section 1605.

PROUDLY ASSEMBLED IN AMERICA

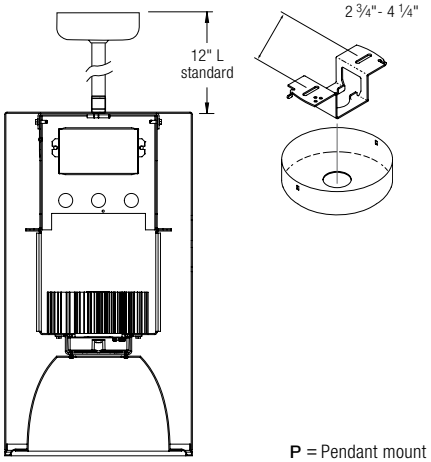
Specifications and dimensions to change without notice.



S = Surface mount



W = Wall mount



P = Pendant mount

P/N Example: SLED1018-SYL11-27K-CL-WH

SLED1018-SYL11-27K-CL-WH

surface mount | lumens | temp | reflector | cylinder finish | option

ordering data

SERIES

Architectural 10"x18" LED (use codes below for mounting options)

SLED1018	Surface mount
WLED1018	Wall mount
PLED1018	Pendant mount
CLED1018	Cord mount with 6' standard

LUMENS*

SYL11	1100 lumen module
SYL15	1500 lumen module
SYL20	2000 lumen module
SYL30	3000 lumen module

COLOR TEMPERATURE

27K	2700K
3K	3000K
35K	3500K
4K	4000K

TRIM Colors

CL	Specular clear
SS	Semi-specular clear
HZ	Haze clear (etched)
WH	Matte white

CYLINDER FINISHES

WH	White
BL	Black
BR	Bronze
MS	Metallic silver
CC	Custom color (consult factory)

OPTIONS

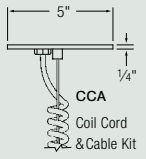
RLEM	Remote Emergency Pack (see note)
LDE	Lutron® EcoSystem® (100%-1%, Fade-to-Black™)
347V	347V Contact Factory
CEM	Canopy mounted 6W emergency battery with integral test button, PLED only

Contact factory for additional dimming drivers.

MOUNTING OPTIONS

P04	4" pendant length
P06	6" pendant length
P18	18" pendant length
P24	24" pendant length
P36	36" pendant length
P48	48" pendant length
FC	Field cut kit
CA	Cord and cable, 6 ft. standard
Cxx	Cord mount with custom length replace xx with length in feet
CA	Cord and cable, 6 ft. standard
CAxx	Cord and cable, custom length replace xx with length in feet
CCA	Coil cord and cable, adjustable from 2 to 8 feet in length
CCA12	Coil cord and cable, from 4 to 12 feet in length
SMJA[1]	Surface mount junction box cover, adjustable. PLED only
SMJF[1]	Surface mount junction box cover, fixed. PLED only

Stem length as field determined





Note 1- SMJA and SMJF not offered with CEM

*Listed lumens and wattages are component measurements, see photometrics for fixture values.

VXBRLED26NDG



High performance 26W LED Vaporproof fixture. A classic design with cutting edge LED technology. Comes with die cast guard and frosted globe.

Color: Natural

Weight: 5.8 lbs

Project:	**Type:**
Prepared By:	**Date:**

Driver Info

Type	Constant Current
120V	0.25A
208V	0.14A
240V	0.13A
277V	0.11A
Input Watts	26.5W

LED Info

Watts	26W
Color Temp	4000K (Neutral)
Color Accuracy	82 CRI
L70 Lifespan	100,000 Hours
Lumens	1,735 lm
Efficacy	65.5 lm/W

Technical Specifications

Compliance

UL Listed:
Suitable for wet locations as a downlight

IESNA LM-79 & LM-80 Testing:
RAB LED luminaires and LED components have been tested by an independent laboratory in accordance with IESNA LM-79 and LM-80.

Performance

Lifespan:
100,000-Hour LED lifespan based on IES LM-80 results and TM-21 calculations

Wattage Equivalency:
Equivalent to 200W Incandescent

Construction

Globes and Guards:
Vaporproof LEDs are compatible with RAB Globes and Guards

Cold Weather Starting:
The minimum starting temperature is -40°C (-40°F)

Ambient Temperature:
Suitable for use in up to 40°C (104°F)

Housing:
All die-cast aluminum construction

Gaskets:
High-temperature silicone

Finish:
Natural shot blasted aluminum

Guard and Globe:
Shot blasted guard with frosted globe

Green Technology:
Mercury and UV free. RoHS-compliant components.

LED Characteristics

LED:
Multi-chip 26W high-output, long-life LED

Color Temperature:
4000K

Color Consistency:
3-step MacAdam Ellipse binning to achieve consistent fixture-to-fixture color

Color Stability:
LED color temperature is warrantied to shift no more than 200K in color temperature over a 5-year period

Color Uniformity:
RAB's range of Correlated Color Temperature follows the guidelines of the American National Standard for Specifications for the Chromaticity of Solid State Lighting (SSL) Products, ANSI C38.377-2011.

Installation

Mounting:
(3) 1/2" NPS conduit entry points

Other

Patents:
The design of the LVAPOR is protected by the following patents US pat. pending; D651738 CN ZL201230040341.3; ZL201130028360.X, TW pat. 101301367 MX 35699; pat. pending CA.

Warranty:
RAB warrants that our LED products will be free from defects in materials and workmanship for a period of five (5) years from the date of delivery to the end user, including coverage of light output, color stability, driver performance and fixture finish. RAB's warranty is subject to all terms and conditions found at rablighting.com/warranty.

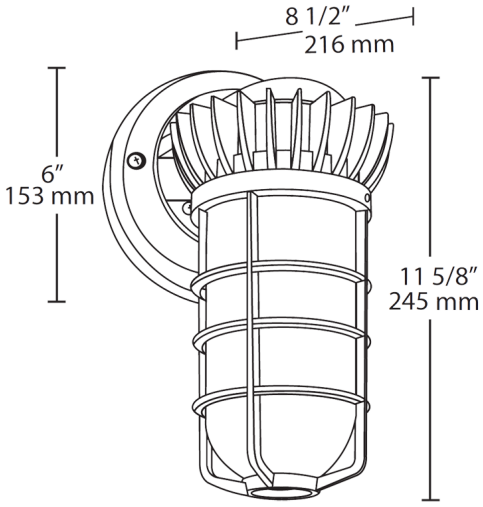
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VXBRLED26NDG

Technical Specifications (continued)

Buy American Act Compliance:
RAB values USA manufacturing! Upon request, RAB may be able to manufacture this product to be compliant with the Buy American Act (BAA). Please contact customer service to request a quote for the product to be made BAA compliant.

Dimensions



Features

- Superior Thermal Management (Patent Pending)
- All Die-Cast Aluminum Construction
- 100,000-hour life based on LM-80 results and TM-21 calculations
- Thermal Shock-Resistant Frosted Glass Globe
- Traditional Look, Cutting-Edge Technology
- 5-Year, No-Compromise Warranty

Ordering Matrix

Family	Wattage	Color Temp	Guard		Size	Options	Other Options
VXBRLED	26	N	DG	–			
	26 = 26W	**Blank =** 5000K Cool **N =** 4000K Neutral **Y =** 3000K Warm	**DG =** Die Cast Guard		**Blank =** Standard **3/4" =** 3/4"	**Blank =** No Option **/PCS =** 120V Swivel Photocell **/PCS2 =** 277V Swivel Photocell	**USA =** BAA Compliant **Blank =** Standard

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Model: WL-LED300

LEDme® Step Light

WAC LIGHTING
Responsible Lighting®



Fixture Type: _____

Catalog Number: _____

Project: _____

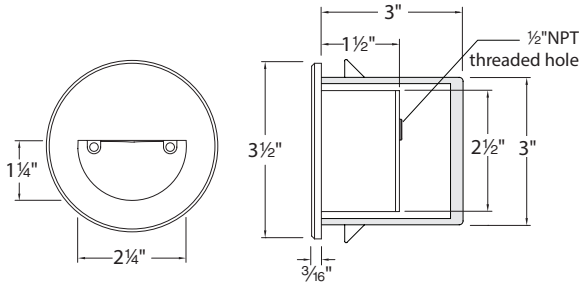
Location: _____

PRODUCT DESCRIPTION

Circular scoop LEDme® Step Light. Designed for safety and style on stairways, patios, decks, balcony areas, walkways and building perimeters.
Features an architectural design. Energy efficient for long-lasting indoor and outdoor lighting solutions. Creates an attractive, romantic impression at night. Colored lights can be used for way finding.

FEATURES

- Direct wiring, no driver needed
- Low profile, flush to wall aesthetics with no visible hardware
- 40,000 hour rated life
- Title 24 Compliant
- Balanced lighting, free of shadows with minimum glare
- Up to 200 fixtures can be connected in parallel
- 5 year WAC Lighting product warranty



ORDER NUMBER

Model		Light Color		Finish		Lumens
WL-LED300	120V	C	White	BN*	Brushed Nickel	30
				BZ	Bronze	33
				WT	White	74
		AM	Amber	BN*	Brushed Nickel	19
				BZ	Bronze	21
				WT	White	38
		RD	Red	BN*	Brushed Nickel	2
				BZ	Bronze	2
				WT	White	4
		BL	Blue	BN*	Brushed Nickel	3
				BZ	Bronze	4
				WT	White	8

*Brushed Nickel Finish is for interior use only

WL-LED300 – [ ] – [ ]

Example: **WL-LED300-C-WT**

SPECIFICATIONS

Construction: Die-cast aluminum

Power: Direct wiring, no remote driver needed
Input voltage: 120VAC 50/60Hz

Light Source: 3000K CCT Samsung HV-AC High Power LED, CRI: 85
Total power consumption of 3.9W

Mounting: Supplied with junction box for recessed installation

Dimming: Dim to 10% with electronic low voltage (ELV) dimmer
Approved dimmers: Lutron Nova-T NTELV-300 & NTELV-600, Lutron Vietri VTELV-600, Lutron Diva DVELV-300P, Lutron Skylark SELV-300P, Lutron Maestro MAELV-600

Standards: IP66, UL & cUL Listed for wet locations, Title 24 Compliant

FINISHES

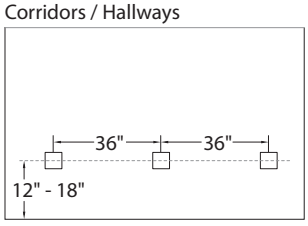
BN BZ WT



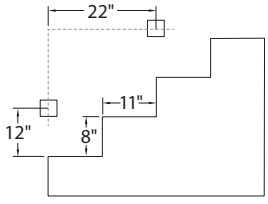
CUSTOM

SPACING RECOMMENDATIONS FOR OPTIMAL LIGHT DISTRIBUTION

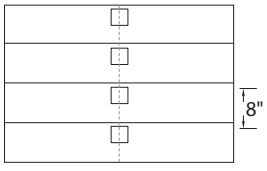
Corridors / Hallways



Stairs - Wall Mount



Stairs - Step Mount



Mount in center of stair as close to the upper tread as possible.
For best results use one light per step for steps narrower than 5'.

waclighting.com
Phone (800) 526.2588
Fax (800) 526.2585

Headquarters/Eastern Distribution Center
44 Harbor Park Drive
Port Washington, NY 11050

Central Distribution Center
1600 Distribution Ct
Lithia Springs, GA 30122

Western Distribution Center
1750 Archibald Avenue
Ontario, CA 91760

WAC Lighting retains the right to modify the design of our products at any time as part of the company's continuous improvement program. OCT 2018

Tracker

Trim-less

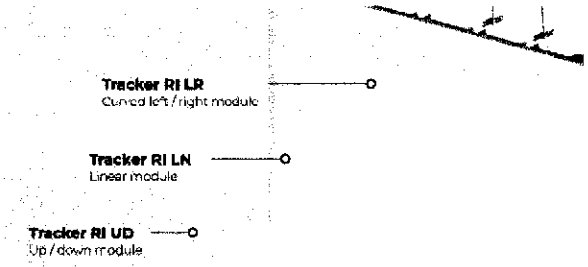
DESIGN PLUS

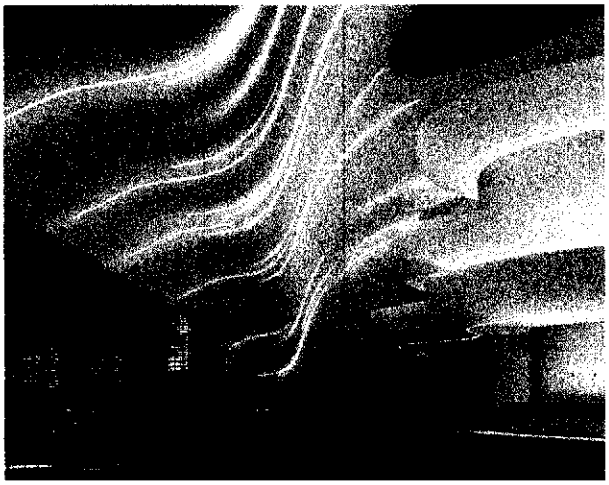
reddot design award winner

Product video

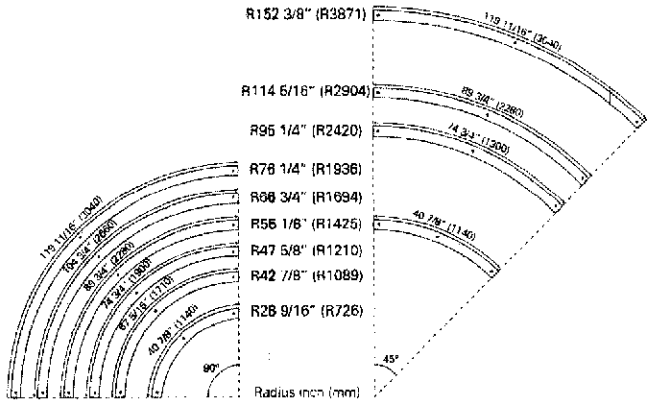
Installation videos

Downloads



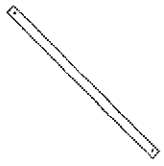


Module types

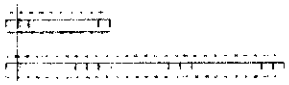


Tracker RI LR 90° modules
1/4 of a circle

Tracker RI LR 45° modules
1/8 of a circle



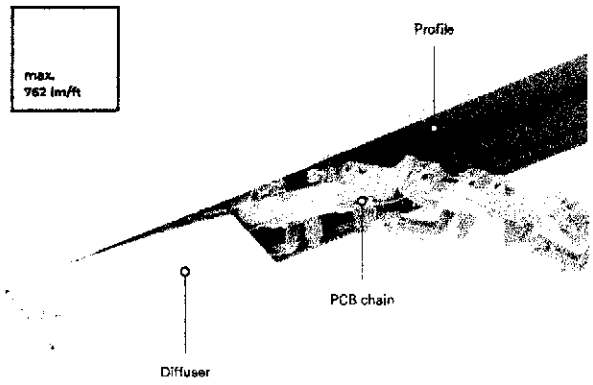
Tracker RI LN modules
from 37 3/8" (950 mm)
up to 119 11/16" (3040 mm)



Tracker RI UD modules
37 3/8" (950 mm) or 187" (4750 mm)
max radius ±19 11/16" (500 mm)

How to order:

Profile + PCB chain + Diffuser + Accessories



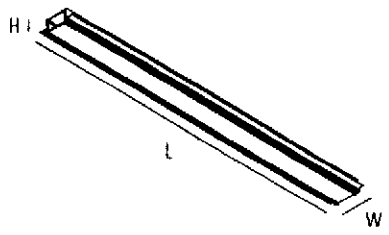
intra lighting

Tracker RI LN

Linear

TRACKER RI LN

TRACKER RI LN



Dimension

inch	W: 2 3/16"	H: 1 1/16"	L:
mm	W: 56	H: 27	See dimensions in the order specification.

Order specification

TRACKER RI LN

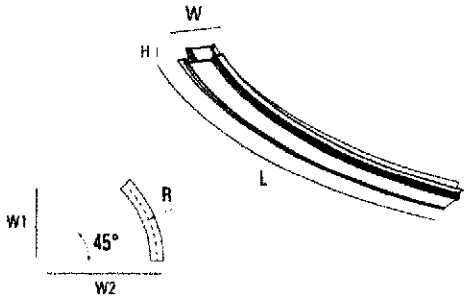
TRACKER RI LN

TRACKER RI LN

B	Length (L)	B	Length (L)
L37	37 3/8"	L78	78 9/16"
L41	41 1/8"	L82	82 5/16"
L44	44 7/8"	L86	86"
L48	48 5/8"	L89	89 3/4"
L52	52 3/8"	L93	93 1/2"
L56	56 1/8"	L97	97 1/4"
L59	59 13/16"	L101	101"
L63	63 9/16"	L104	104 3/4"
L67	67 5/16"	L108	108 7/16"
L71	71 1/16"	L112	112 3/16"
L74	74 13/16"	L115	115 15/16"
		L119	119 11/16"

Tracker RI LR 45°

Curved left/right



Dimension

inch	W: 2 3/16"	H: 1 1/16"	L/R:
mm	W: 56	H: 27	See dimensions in the order specification.

Order specification

TRACKER RI LR 45°

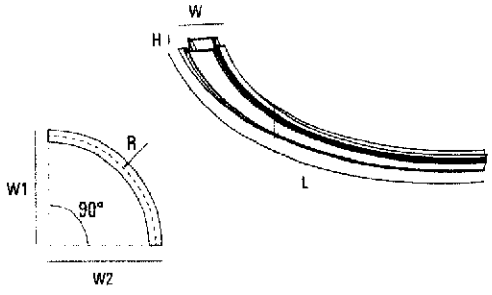
TRACKER RI LR 45°

TRACKER RI LR 45°

A	Optics
DPR	Soft-light prismatic diffuser
SOP	Satin opal diffuser
B	**Radius (R)**
R57	57 3/16"
R95	95 1/4"
R114	114 5/16"
R152	152 3/8"

Tracker RI LR 90°

Curved left/right



Dimension

inch	W: 2 3/16"	H: 1 1/16"	L/R:
mm	W: 56	H: 27	See dimensions in the order specification.

Order specification

TRACKER RI LR 90°

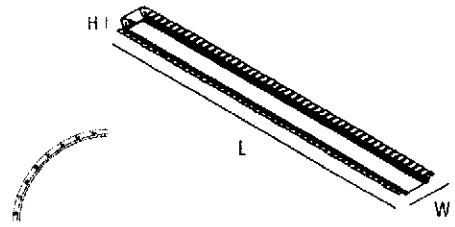
TRACKER RI LR 90°

TRACKER RI LR 90°

A	Optics
DPR	Soft-light prismatic diffuser
SOP	Satin opal diffuser
B	**Radius (R)**
R28	28 9/16"
R42	42 7/8"
R47	47 5/8"
R57	57 3/16"
R66	66 11/16"
R76	76 1/4"

Tracker RI UD

Up/down



Dimension

inch	W: 2 3/16"	H: 1 1/16"	L:
mm	W: 56	H: 27	See dimensions in the order specification

Order specification

TRACKER RI UD

TRACKER RI UD

B	Length (L)
L37	37 3/8"
L187	187"

LED PCB chain

PCB chain

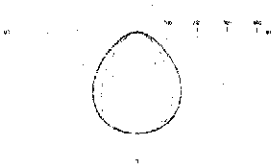
A	Led color
827	2700K, CRI>80
830	3000K, CRI>80
835	3500K, CRI>80
840	4000K, CRI>80
B	**Number of LED PCB**
1PCB	LED module chain L 3 3/4", 1x LED PCB
10PCB	LED module chain L 37 3/8", 10x LED PCB
50PCB	LED module chain L 187", 50x LED PCB
C	**Light output**
M	Medium
H	High

NOTES 1. The total length of the PCB chain must correspond to the total light line length.

Photometrics



Satin opal diffuser (SOP)



Soft-light prismatic optics (DPR)

Light output (lm/ft)

LED Color	SOP (Medium)	SOP (High)	DPR (Medium)	DPR (High)

Diffuser in a reel

Code	Diffuser
12680111000	Diffuser W60 SOP 492 1/8"
12680112000	Diffuser W60 SOP 984 1/4"
12680121000	Diffuser W60 DPR 492 1/8"
12680122000	Diffuser W60 DPR 984 1/4"

NOTES 1. for straight LN and UD modules only. Curved LR modules already include the diffuser
2. the total length of the diffuser in a reel must correspond to the total LN and UD module length

intra lighting

Remote driver

Code	Drivers with metal housing	Dimensions LWH (mm)	Dimensions LWH (in)
192100000003	Driver box LC 60W 24V 0-10V UNV	251x57x43	9 7/8" x 2 1/4" x 1 11/16"
192200000004	Driver box LC 100W 24V 0-10V UNV	335x57x43	13 3/16" x 2 1/4" x 1 11/16"

Code	Drivers without the housing	Dimensions LWH (mm)	Dimensions LWH (in)
702120310	Driver LC 60W 24V 0-10V UNV	148x45,6x25,4	5 13/16" x 1 13/16" x 1"
702120311	Driver LC 100W 24V 0-10V UNV	241,3x45,6x25,4	9 1/2" x 1 13/16" x 1"

Code	Driver type	Nmax [1]	Lmax [2]	Nmax [1]	Lmax [2]

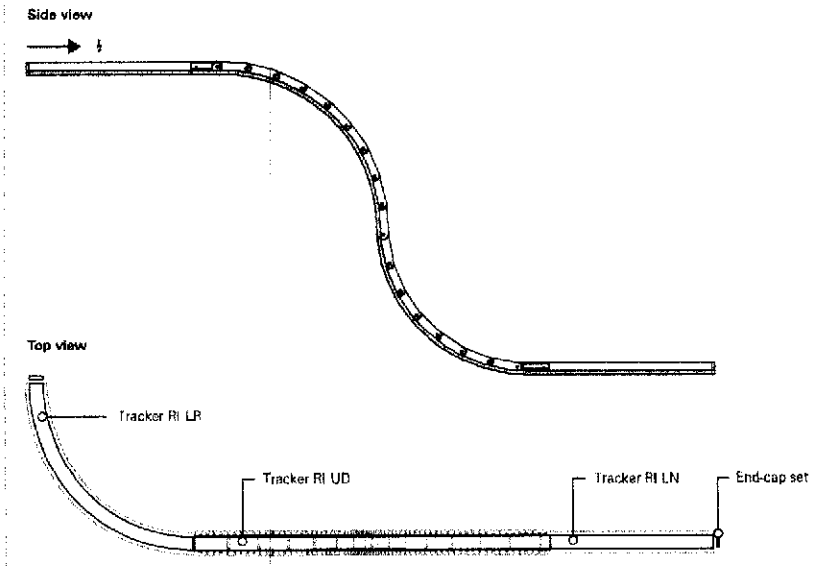
NOTES
1. Nmax: maximum number of LED modules/driver
2. Lmax: maximum length of LED chain/driver
3. Power consumption MEDIUM output: 5 W/ft module
4. Power consumption HIGH output: 7.3 W/ft module

Product parts

Code	Product parts
12680301100	Tracker end-cap set (2pcs) [1]
12680302100	Tracker mounting/cleaning tool set [2]
12680303100	Tracker power inlet set [3]
12680304100	Tracker suspender set (3pcs) [4]
12680306100	Diffuser opener [5]

NOTES
1. One set per light line. Not required in case of the closed loop.
2. Recommended quantity one set every 80 ft of installed light line.
3. Equal to the drivers quantity.
4. Recommended quantity one set every 6 ft of installed light line.
5. Recommended quantity one piece every 150 ft of installed light line.

Order example



Modules:
1pc Tracker RI LR SOP R42 7/8"
1pc Tracker RI UD 187"
1pc Tracker RI LN 48 5/8"

LED PCB chain:
1pc Led module chain L187, 50x LED PCB

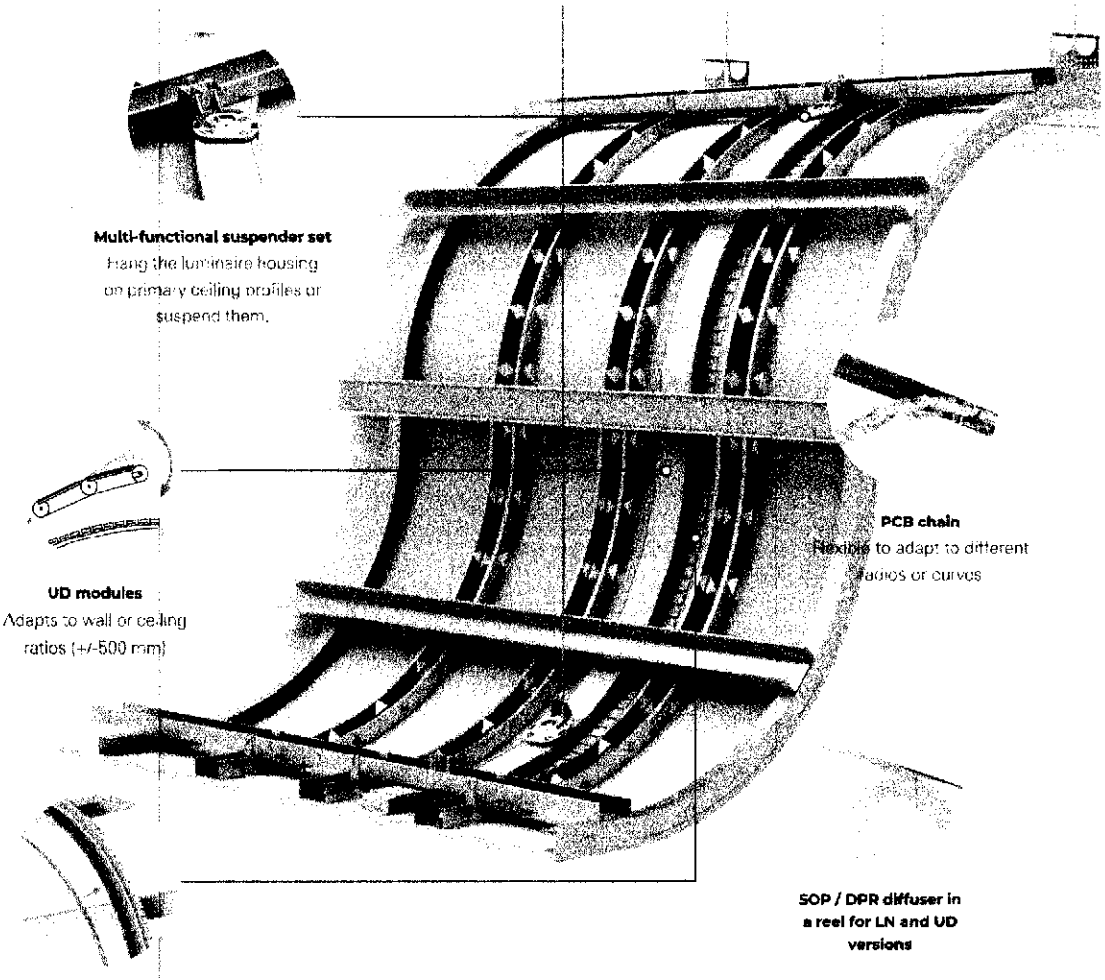
Diffuser in a reel:
1pc Diffuser W60 SOP 492 1/8"

Remote driver:
1pc Driver box LC 60W 24V 0-10V UNV

Product parts:
1pc Tracker end-cap set
1pc Tracker mounting/cleaning tool set
1pc Tracker power inlet set

Please note: Drywall radius can not be 100% accurate, therefore you need to order longer Tracker UD module than needed. This way, you make sure UD module will end on straight ceiling. You can then cut Tracker LN module to the required dimension.

Main features



Multi-functional suspender set
Hang the luminaire housing on primary ceiling profiles or suspend them.

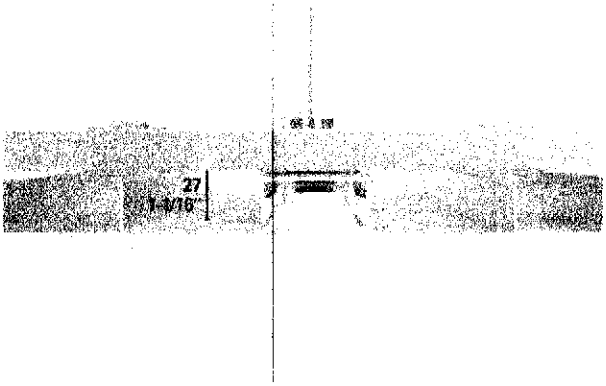
UD modules
Adapts to wall or ceiling ratios (+/-500 mm)

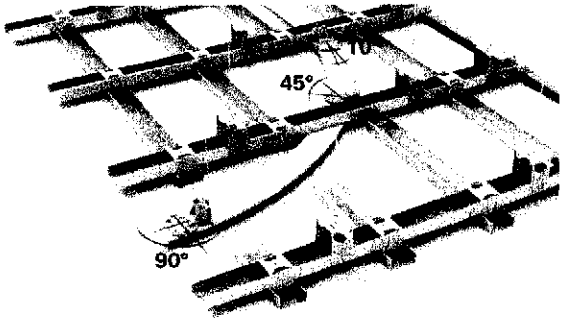
PCB chain
Flexible to adapt to different radios or curves

SOP / DPR diffuser in a reel for LN and UD versions

UD side profile
Strengthens the form to fit to ceiling radius

Watch installation videos





Goes under the primary ceiling construction

Tracker fits perfectly with standard construction elements. Cutting primary ceiling profiles is not necessary due to the product height.

Plaster thickness (mm): 12,5 / 15,8 / 25

Simple installation

The installation of linear and curved modules is simple due to innovative installation tools and product construction. Cutting the primary ceiling profiles is not required, so it does not weaken the ceiling load capacity.

Compact floodlight · Wide beam

BEGA

Type:
BEGA Product:
Project:
Modified:

Application
Compact floodlight with mounting canopy for direct mounting to horizontal or vertical surfaces. Designed to illuminate architectural features, signage, landscaping, or to provide general illumination in a space. Pair with a variety of optical accessories.

Materials
Clear safety glass
Marine grade, copper free (≤ 0.3% copper content) A360.0 aluminum alloy
High temperature silicone gasket
Mechanically captive stainless steel fasteners
Pure anodized aluminum reflector
Silicone optic with excellent high temperature and UV stability

NRTL listed to North American Standards, suitable for wet locations
Protection class IP 65

Weight: 9.7 lbs.

EPA (Effective projection area): 0.5 sq. ft.

Electrical

Operating voltage	120-277V AC
Minimum start temperature	-30° C
LED module wattage	48.2 W
System wattage	51.0 W
Controllability	0-10V dimmable
Color rendering index	Ra > 90
Luminaire lumens	4119 lm
LED service life (L70)	60000 hrs

LED color temperature
☐ 4000K (K4)
○ 3500K (K35)
○ 3000K (K3)
○ 2700K (K27)

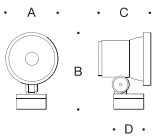
BEGA can supply you with suitable LED replacement modules for up to 20 years after the purchase of LED luminaires - see website for details

Finish
All BEGA standard finishes are matte, textured powder coat with minimum 3 mil thickness. BEGA Unidure® finish provides superior fade protection in Black, Bronze, and Silver. BEGA standard White is a super durable polyester powder. Optionally available RAL and custom color finishes provided in either polyester powder or liquid paint.

Available colors
☐ Black (BLK)
○ Silver (SLV)
○ RAL:
○ Bronze (BRZ)
○ White (WHT)
○ CUS:

Available options

☐ B70065	Elliptical spread lens
☐ B70721	Glare shield · 360°
☐ B70758	Glare shield · 180°
☐ CUS	Custom finish
☐ DALI	Digital addressable lighting interface
☐ FSC	Fusing
☐ MGU	Marine grade undercoat
☐ RAL	RAL finish





Compact floodlight · Wide beam

	LED	☐	A	B	C	D
B77689	48.2 W	50°	9 1/8	12	8 5/8	5 1/8

BEGA 1000 BEGA Way, Carpinteria, CA 93013 (805) 684-0533 info@bega-us.com

Due to the dynamic nature of lighting products and the associated technologies, luminaire data on this sheet is subject to change at the discretion of BEGA North America. For the most current technical data, please refer to bega-us.com
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Updated 12/18/24

BL flexFORM W5

Flexible LED Optic Wall Grazer,
24VDC, Constant Voltage

BL LIGHTING SINCE 1986

Delivering up to 522 lumens per foot, BL flexFORM W5 LED Optic Wall Grazer is a powerful, flexible and compact linear LED lighting solution. Deliver efficiency up to 87lm/w and target smooth wall wash, beam and graze effects. Custom tailored continuous run lengths up to 14.5ft make the BL flexFORM W5 a perfect choice for landscape, signage and architectural highlighting. Safe 24VDC operation, dimmable, and IP65 rated for indoor or outdoor use. Available in 2700K, 3000K or 4000K.

CLIENT	
PROJECT NAME	
LOCATION	
DATE	

Up to 522 lm/ft | **6W/FT** | **90+ CRI**

Product Detail



IP65 · LOW · DIM · DMX · Bluetooth

5 YEAR WARRANTY · c UL us LISTED

Lighting	Number of LED's	14 Diodes/FT (46/m)
	Lamp	SMD 5060
	Beam Angle	White: 10°, 30°, 45° (Asymmetric), RGBW: 45°
	Average Life	50,000 Hours
	CCT Binning	SDCM <3 LED's
Electrical	Controls	0-10V, MLV, ELV, Phase-Cut, Triac, DMX, Bluetooth
	Input Voltage	24VDC
	Max Input Current	5A
	Connections	20AWG, Copper Conductors
	Circuit	Class 2
Mechanical	Housing Construction	Flexible PCB Board, Silicone Jacket
	Mounting Options	Channel, Clip
Environmental	Ingress Protection	IP65
	Certifications	cULus
	Operating Temperature	-4°F to 104°F (-20°C to 40°C)

Performance

CCT/Color		2700K	3000K	4000K	RGBW(3000K)
Power	W/FT (W/m)	6 (19.6)			
Lumens	lm/FT (lm/m)	480 (1,575)	510 (1,673)	522 (1,712)	320(1,050)
Efficacy	lm/W	80	85	87	53
CRI	CRI	90+			-
Increment	inch (mm)	6 (152)			
Max. Length	ft (m)	14ft 6in (4.4m)			

Ordering

Product Code	Beam	CCT/Color	IP Rating
BL flexFORM OWW W5		3500K	
	10°	2700K	IP65
	30°	3000K	
	45° (Asymmetric)	4000K	
	45° (RGBW only)	RGBW(3000K)	

Dimensions



Section		A	B	C	D
		inch (mm)			
	DMP(IP65)	0.78 (19.8)	6 (152.4)	0.94 (24)	0.39 (10)

BL LIGHTING
ILLUMINATE EVERYTHING

111 - 8838 Heather St. Vancouver, BC. Canada. V6P 3S8
P: 1-604-874-4405 E: info@bllighting.com
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Solid State Lighting is sensitive to power fluctuations. Surge protection is highly recommended for all LED lighting products and should be on a dedicated circuit to protect against premature failure. Lack of surge protection may void your warranty.

Designed & Assembled in North America.

Specifications subject to change without notice. Please refer to our website at bllighting.com for current technical data.

For more information, please downlad the BL LIGHTING catalog

bllighting.com

BL flexFORM W5

Flexible LED Optic Wall Grazer,
24VDC, Constant Voltage

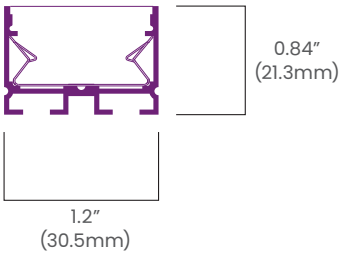
BL LIGHTING SINCE 1986

Mounting Channel

Surface Mount Profile with Flat, Opaque Lens Optic. Unit Includes Base Track, Lens Optic, Plastic End Caps with Screws & Surface Mounting Clips, IP20, MAX. 4FT LENGTH

Part# **OWW SF 3021 FR IP20**

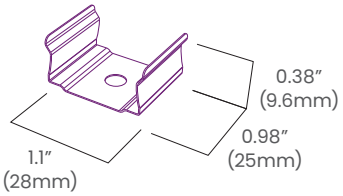




Surface Mount clip

Part# **OWW SFCP**





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bllighting.com

Butterfly® 3600

Indirect or Wallwash LED

120-277VAC | IP66

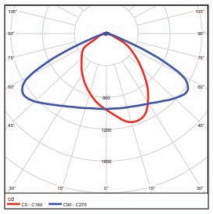
Project

Date

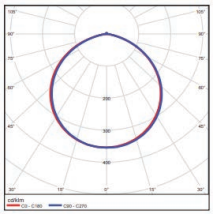




STANDARD
FORWARD THROW



OPTIONAL
WIDE FORWARD THROW



CCT	30K, 35K, 40K, 50K								
Length	16"					24"			
LED Output	L25	L50	L75	L100	L150	L160	L190	L240	L320
Wattage	25W	50W	75W	100W	150W	160W	190W	240W	320W
Lumens	3,500	7,000	10,500	14,000	21,000	22,400	26,600	33,600	44,800
Weight	12 lbs					24 lbs			

DESCRIPTION

The Butterfly is a powerful indirect LED wall or pendant mounting fixture which provides forward throw indirect lighting. The slim, clean architectural design with superior performance eliminates the discomfort of the glare associated with direct LED lighting. Designed for illuminating large volume spaces such as malls, churches, sports halls and airports.

FEATURES

Construction	Durable Die-Cast Aluminum Housing. Stainless Steel Hardware. High impact protective lens.
Dimensions (WxLxH)	13"W x 16.75"L x 2.8"H / 13"W x 24.75"L x 5.125"H
CCT	3000K, 3500K, 4000K, 5000K
Dimming	Non-dimming, 0-10V Dimming
Optics	Standard Forward Throw or Optional Wide Forward Throw Rotatable Lenses (Every 90˚)
Mounting	Flush Mount, Yoke Mount, 4" Swivel Mount, Extended Arm, Pendant Mount (Single, Double).
Finish	Epoxy Powder Coated Silver, White, Black, Bronze, Custom

PERFORMANCE

Electrical	120-277V AC / 277-480V AC Input line voltage
LED Wattage	25W, 50W, 75W, 100W, 150W, 160W, 190W, 240W, 320W
Environment	IP66 - Suitable for Wet Locations. Natatorium - Marine Grade Finish Operating Temperature - 40˚F to 122˚F
Warranty	5 yr / 50,000 hour limited warranty
CRI	80+
Certifications	UL Listed

ORDERING GUIDE Make selections by filling out the top row or highlighting options.

3600								
SERIES	LENGTH	OUTPUT	CCT	VOLTAGE	CONTROL	MOUNTING	FINISH	ACCESSORY
3600	**16** 16" nom	**L25** 25W **L50** 50W **L75** 75W **L100** 100W **L150** 150W	**30** 3000K **35** 3500K **40** 4000K **50** 5000K	**U** 120-277V **U2** 277-480V	**ND** NON DIMMING **D1** 0-10V DIMMING	**B4** 4" SWIVEL MOUNT **Ax*** EXTENDED ARM **YK** YOKE MOUNT **BF** FLUSH MOUNT **PSx*** PENDANT SINGLE X **PDx*** PENDANT DOUBLE X **CU** CUSTOM MOUNT 36" MAX EXTENDED ARM | 120" MAX PENDANT	**SO** SILVER **WH** WHITE **BL** BLACK **BZ** BRONZE **CU** CUSTOM	**M** MARINE GRADE FINISH **2** NATATORIUM **E** EMERGENCY DRIVER (remote location) **W** WIDE OPTIC **N** NONE
	24 24" nom	**L160** 160W **L190** 190W **L240** 240W **L320** 320W						

X=STEM LENGTH (IN INCHES)

Specifications sheets are subject to change without notification.

Butterfly® 3600

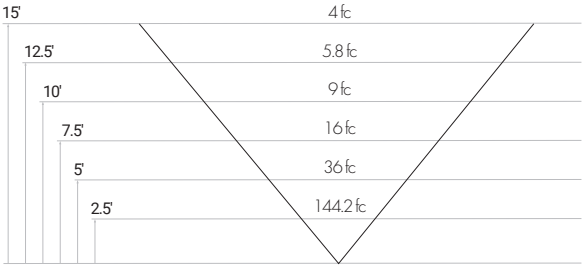
ORGATECH

PHOTOMETRICS

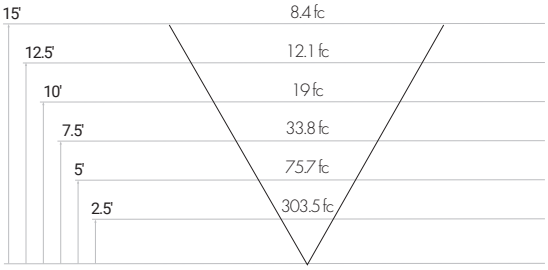
25 WATT - FORWARD THROW



25 WATT - WIDE FORWARD THROW



50 WATT - FORWARD THROW



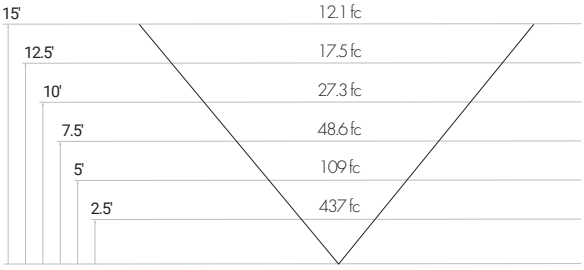
50 WATT - WIDE FORWARD THROW



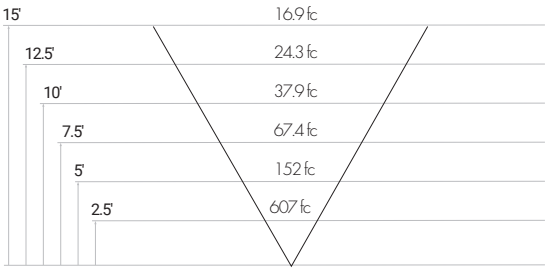
75 WATT - FORWARD THROW



75 WATT - WIDE FORWARD THROW



100 WATT - FORWARD THROW



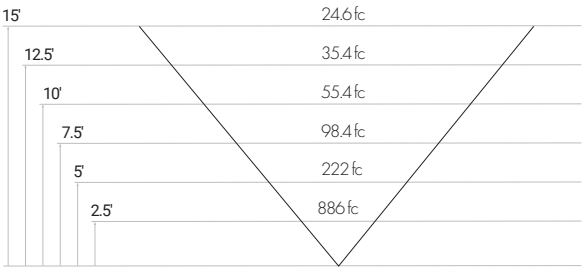
100 WATT - WIDE FORWARD THROW



150 WATT - FORWARD THROW



150 WATT - WIDE FORWARD THROW



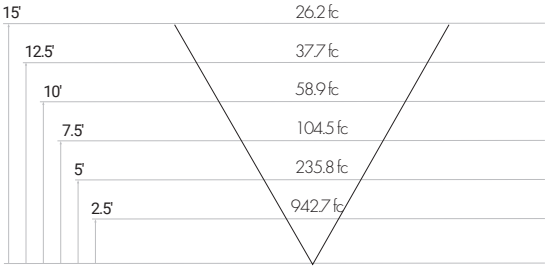
Specifications sheets are subject to change without notification.

Butterfly® 3600

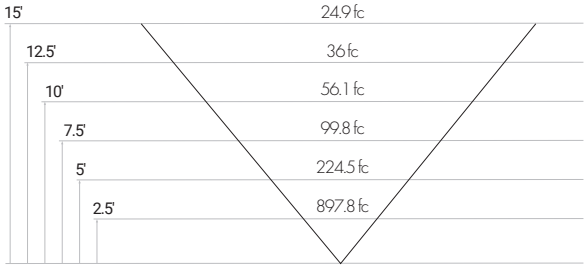
ORGATECH

PHOTOMETRICS

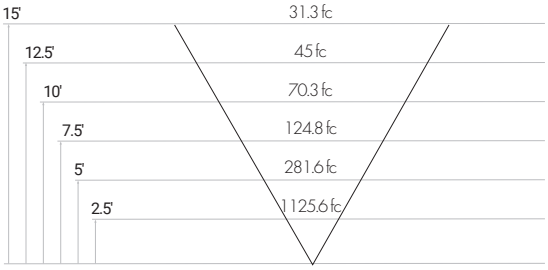
160 WATT - FORWARD THROW



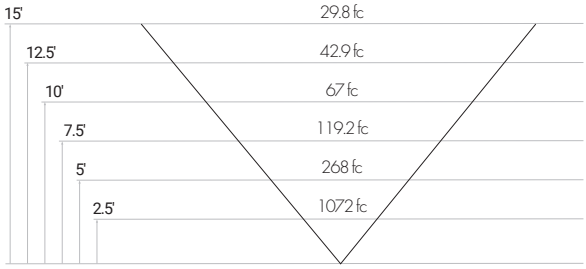
160 WATT - WIDE FORWARD THROW



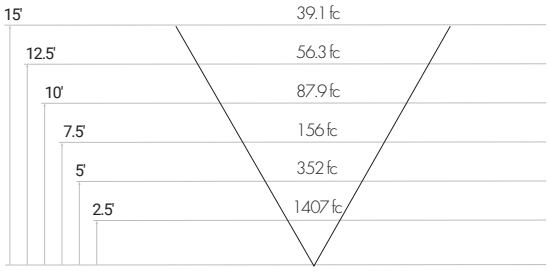
190 WATT - FORWARD THROW



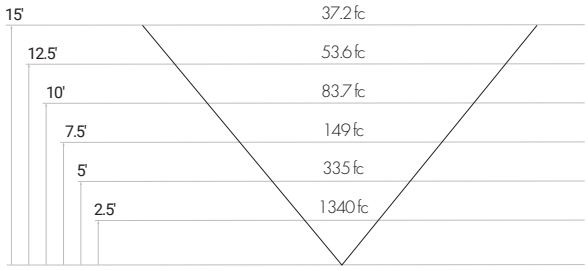
190 WATT - WIDE FORWARD THROW



240 WATT - FORWARD THROW



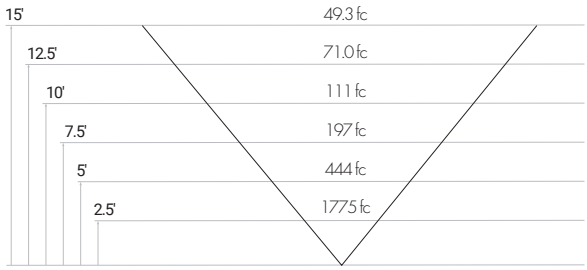
240 WATT - WIDE FORWARD THROW



320 WATT - FORWARD THROW



320 WATT - WIDE FORWARD THROW



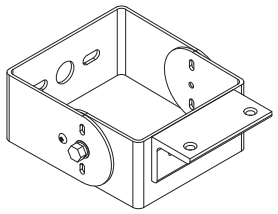
Butterfly® 3600

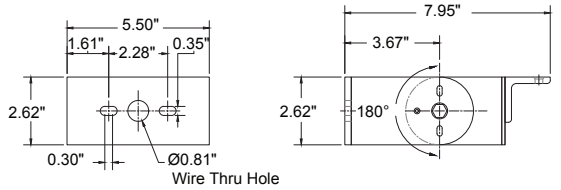
ORGATECH

MOUNTING OPTIONS AND ACCESSORIES

B4 4" Swivel Mount

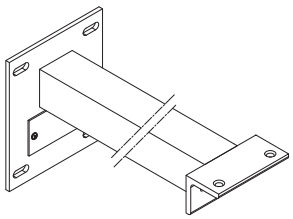
A heavy duty adjustable mounting bracket with locking bolts.

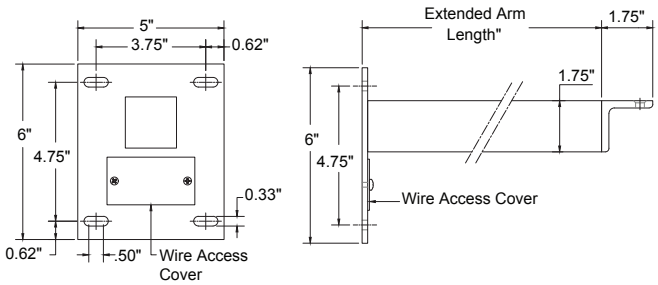




Ax Extended Arm

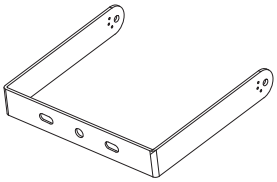
Available in 4"-36" lengths. Power cords are routed through arms, exiting close to the wall to connect to an adjacent j-box or other power outlet, providing a tidy installation.

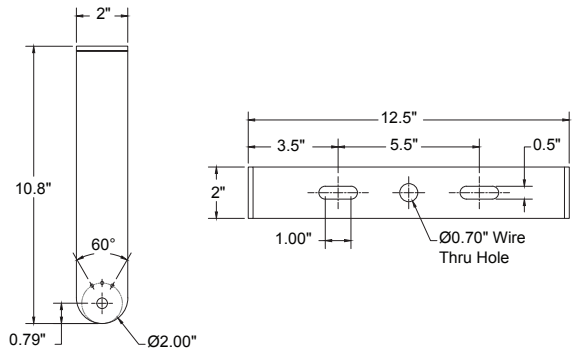




YK Yoke Mount

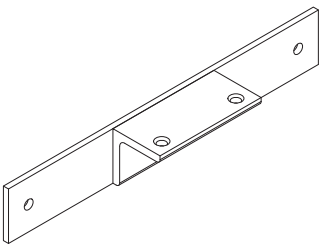
Implements rotary mechanics to the luminaire enables directional adjustment simplicity. Mounts to structure cover via (2) 1/4" screws.

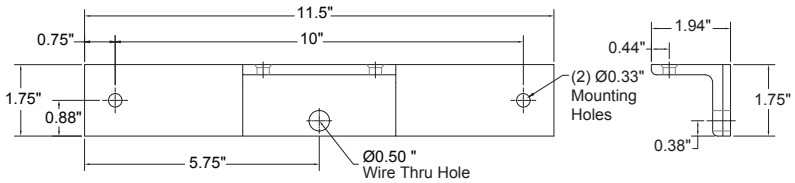




BF Flush Mount

Standard mounting with back plate.





Specifications sheets are subject to change without notification.

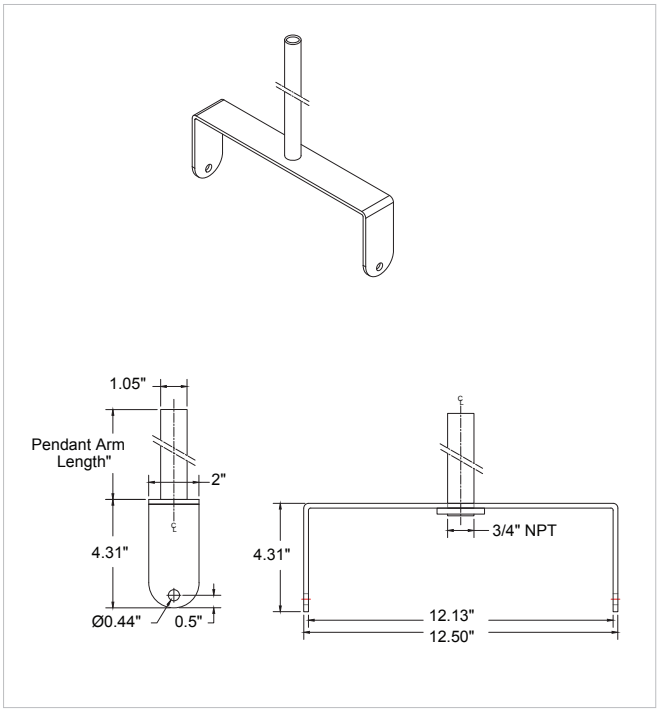
Butterfly® 3600

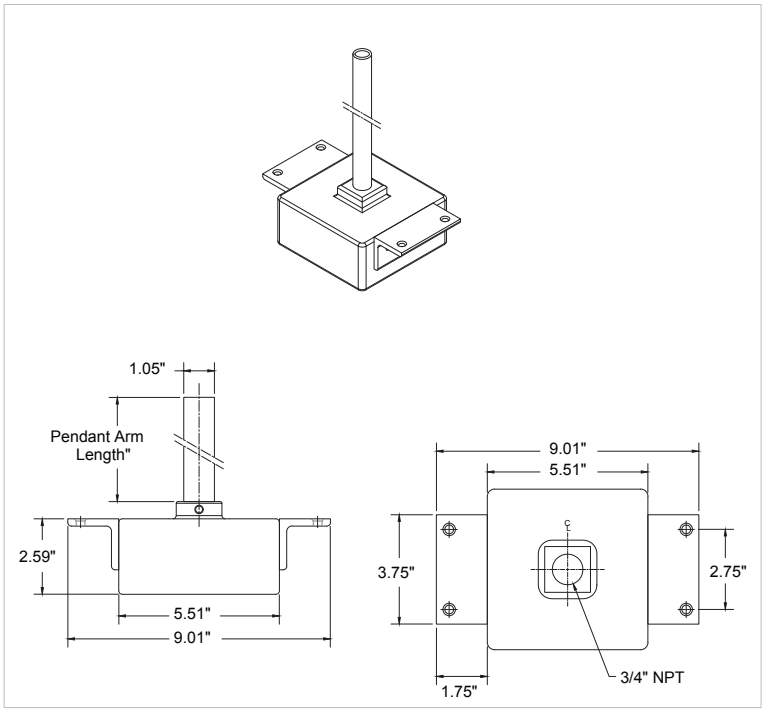
ORGATECH

MOUNTING OPTIONS AND ACCESSORIES

PS36, PD36 Single, Double Pendant Mount

Available for single and double fixtures. Standard 36" stems. Fixtures are designed to be mounted above 6' 4".



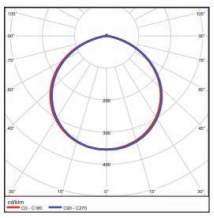


ACCESSORIES

W Wide Optic

Wide forward throw lens



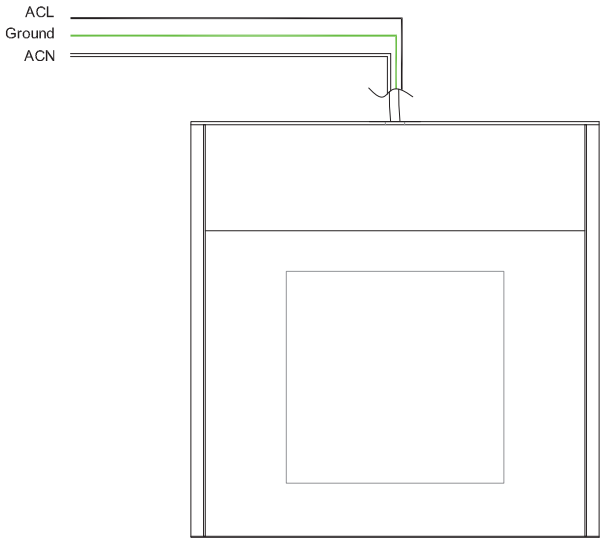


Butterfly® 3600

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ELECTRICAL DETAILS

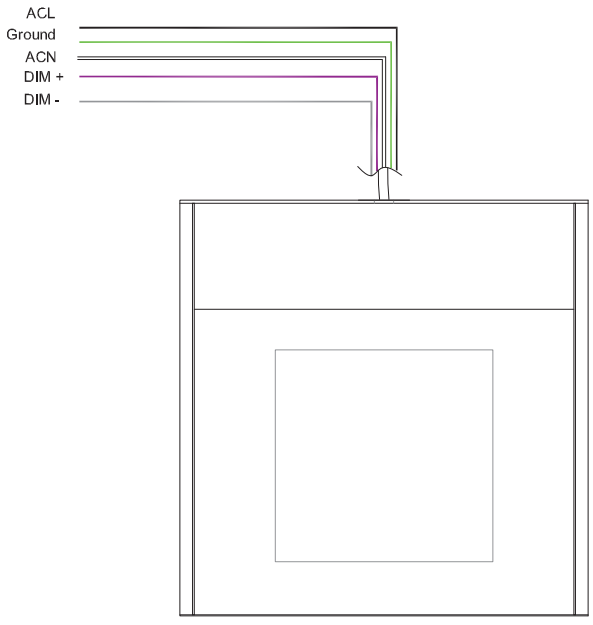
Non-Dimming | 3 Wire | 120-277V



BLACK	WHITE	GREEN
POWER +	NEUTRAL -	GROUND

0-10V Dimming | 5 Wire | 120-277V

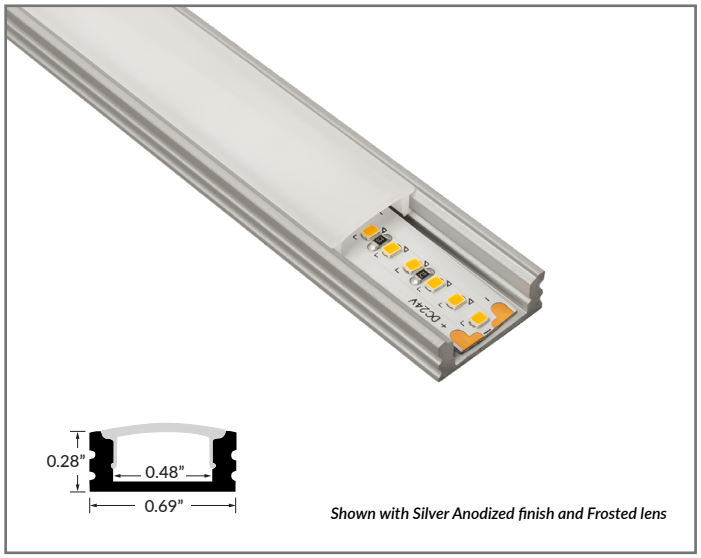
BLACK	WHITE	GREEN	PURPLE	GREY
POWER +	NEUTRAL -	GROUND	DIM +	DIM -



LLI ARCHITECTURAL LIGHTING

PROJECT	SPECIFIER
SKU	
QUANTITY	DATE

THIN EXTRUSION + LED TAPELIGHT



Shown with Silver Anodized finish and Frosted lens

5 YEAR LIMITED WARRANTY

DIMMABLE

ASSEMBLED IN THE USA

SPECIFICATIONS

FINISH	Silver Anodized, Black Powder Coat, White Powder Coat
LENS	Frosted, Clear, White, Black
WATTAGE	0.75W/ft to 5.9W/ft
IP RATING	IP20, IP65 – rating applies to tapelight, see page 2 for details
CCT / COLOR	2200K - 5200K; RGB; RGBW; tunable white; warm fade
BEAM ANGLE	105° typical with Frosted lens
INPUT VOLTAGE	24VDC
LENGTH	Made to order. Actual lengths vary by LED tapelight cut points. Maximum assembled length is 94in. Lengths over 94in are made with multiple sections, shipped unassembled.
OUTPUT	78 to 806 lm/ft with Frosted lens
LEDS	Single binned LEDs +/- 30-70 CCT, MacAdam 3 SDCM
MATERIAL	Extrusion - Anodized aluminum; Lens - Polycarbonate
MOUNTING	Mounting clips recommended
POWER SUPPLY	Requires a 24V power supply – see page 5
WARRANTY	IP20 - 5 year limited, IP65 - 3 year limited

FEATURES & RECOMMENDED APPLICATIONS

Surface-mount extrusion for sleek lighting with a minimalist profile. Good for accent, general, under cabinet, displays, shelving, signage.



PRODUCT: LLI-THN-SF-H4.4W-30K-24V-48IN

LLI ARCHITECTURAL LIGHTING

THIN EXTRUSION + LED TAPELIGHT

ORDERING GUIDE

← PRODUCT CODE

PROFILE	1a. FINISH	1b. LENS	2. LED	3. IP RATING*	4. CCT / COLOR	INPUT	5. LENGTH
LLI-THN	S	F	2.2W	65	30K	24V	48IN
	Silver Black White	Frosted Clear White Black	WATTS/FT 0.75-5.9 W/ft	[blank] - IP20 65 - IP65	22K-52K Warm Fade Tunable White Static Color RGB RGBW		Enter overall length in inches. Length can be a complete section (if under max run) or separated into smaller sections. Nominal length only. Actual lengths vary by LED cut point.

OPTIONAL →

6. MOUNTING	POWER FEED 7. LEAD TYPE	8. LEAD LENGTH	9. FEED TYPE
[blank]	[blank]		
Default [blank] - Ships standard with standard clips. Refer to section 6 on the next page if you require alternate mounting.	Default [blank] - 48" hard wire end feed (PWR48EF) Refer to section 7 on the next page for an alternate power feed configuration.		

More LED tapelight and color options available upon request. Visit www.llialighting.com or contact us for details.

1. FINISH & LENS

1a. FINISH: S

S	Silver Anodized finish
B	Black Powder Coat finish
W	White Powder Coat finish

1b. LENS: F

F	Frosted lens
C	Clear lens
W	White lens (special order)
B⁺	Black lens (special order)⁺

⁺*80% light loss factor*

2-4. LED TAPELIGHT OPTIONS

2. LED CODE	3. IP RATING*	4. CCT / COLOR
H4.4W	[blank]	30K

For IP20, leave {blank}.

TECHNICAL DATA

	WATTAGE	DELIVERED LM/FT @ 30K^	FROSTED LENS APPEARANCE**	CRI	MAX. RUN	CUT POINTS*
T0.75W (White)	20 / 65	22K / 27K / 30K / 35K / 42K / 52K	0.75 W/ft	**78 lm/ft**	SEMI-UNIFORM	90+	26 ft	1"
1.5W (White)	20 / 65*	22K / 27K / 30K / 35K / 42K / 52K	1.5 W/ft	**145 lm/ft**	IMAGING	90+	60 ft*	3.9"
T1.5W (White)	20 / 65	22K / 27K / 30K / 35K / 42K / 52K	1.5 W/ft	**157 lm/ft**	SEMI-UNIFORM	90+	26 ft	1"
★ **2.2W** (White)	20 / 65*	22K / 27K / 30K / 35K / 42K / 52K	2.2 W/ft	**193 lm/ft**	IMAGING	90+	60 ft*	3.9"
2.5W (White)	20 / 65	22K / 24K / 27K / 30K / 35K / 42K / 52K	2.5 W/ft	**191 lm/ft**	IMAGING	90+	32 ft	2"
T2.5W (White)	20 / 65	22K / 27K / 30K / 35K / 42K / 52K	2.5 W/ft	**206 lm/ft**	SEMI-UNIFORM	90+	20 ft	1"
♦ **WF3.5W** (Warm Fade)	20 / 65	**27D** (18-27K) / **30D** (18-30K)	3.5 W/ft	**219 lm/ft**	IMAGING	90+	16 ft	2.5"
3.5W (White)	20 / 65	22K / 27K / 30K / 35K / 42K / 52K	3.5 W/ft	**243 lm/ft**	IMAGING	90+	40 ft	2.5"
TW2.7W (Tunable White)	20 / 65	**1835** (18-35K) / **2235** (22-35K) / **2752** (27-52K)	2.7 W/ft	**283 lm/ft**	IMAGING	90+	26 ft	3.3"
★ **4.4W** (White)	20 / 65	22K / 24K / 27K / 30K / 35K / 42K / 52K	4.4 W/ft	**296 lm/ft**	IMAGING	90+	32 ft	2"
★ **CB4.6W** (White COB)	20	27K / 30K / 35K / 40K	4.6 W/ft	**350 lm/ft**	UNIFORM	90+	16 ft	2"
H3.5W (White)	20 / 65	22K / 27K / 30K / 35K / 42K / 52K	3.5 W/ft	**397 lm/ft**	SEMI-UNIFORM	90+	32 ft	2.5"
T5.0W (White)	20 / 65	22K / 27K / 30K / 35K / 42K / 52K	5.0 W/ft	**398 lm/ft**	SEMI-UNIFORM	90+	13 ft	1"
★ **H4.4W** (White)	20 / 65	22K / 24K / 27K / 30K / 35K / 42K / 52K	4.4 W/ft	**473 lm/ft**	SEMI-UNIFORM	90+	32 ft	2"
R5.4W (White, High R9)	20 / 65	22K / 27K / 30K / 35K / 42K / 52K	5.4 W/ft	**473 lm/ft**	UNIFORM	95+	16 ft	1"
TW5.3W (Tunable White)	20 / 65	**1835** (18-35K) / **2235** (22-35K) / **2752** (27-52K)	5.3 W/ft	**494 lm/ft**	IMAGING	90+	16 ft	3.3"
H5.3W (White)	20	27K / 30K / 35K / 42K / 52K	5.3 W/ft	**689 lm/ft**	SEMI-UNIFORM	90+	16 ft	2"
★ **HO5.9W** (White)	20	27K / 30K / 35K / 42K / 52K	5.9 W/ft	**806 lm/ft**	SEMI-UNIFORM	90+	16 ft	2"
C2.2W (Static Color)	20 / 65	RED / AMB / GRN / BLU	2.2 W/ft	**N/A**	IMAGING	–	60 ft	3.9"
C4.4W (Static Color)	20 / 65	RED / AMB / GRN / BLU	4.4 W/ft	**N/A**	IMAGING	–	32 ft	2"
CC4.4W (RGB)	20 / 65	RGB	4.4 W/ft	**107 lm/ft**	IMAGING	–	32 ft	3.9"
★ **TC4.4W** (RGB)	20 / 65	RGB	4.4 W/ft	**156 lm/ft**	IMAGING	–	16 ft	2"
★ **CC5.9W** (RGB)	20 / 65	RGB	5.9 W/ft	**288 lm/ft**	IMAGING	–	32 ft	2.8"
CW5.8W (RGBW)	20	**R30** (RGB + 30K) / **R60**	5.8 W/ft	**260 lm/ft**	IMAGING	80+	32 ft	3.9"
CW7.0W (RGBW)	20	**R30** (RGB + 30K) / **R60**	7.0 W/ft	**302 lm/ft**	IMAGING	90+	28 ft	2.5"
CW7.6W (RGBW)	20	**R22** (RGB + 22K) / **R27** / **R30** / **R35** / **R42** / **R52**	7.6 W/ft	**318 lm/ft**	IMAGING	90+	16 ft	2.5"

⁺ *1.5W and 2.2W IP65 tapelight maximum run is reduced to 50 ft, only IP20 may reach maximum run of 60 ft.*
★ *Recommended options.*
♦ *Warm Fade tapelight requires a UDEFF or 0-10V dimmable power supply.*
** *Diode visibility data tested at 100% output. Diodes may become more visible as tapelight dims.*
^ *Lumen data based on frosted lens, IP20 tapelight, 30K white output, or combined output for tunable white, warm fade, RGB, and RGB(W) tapelights.*
* *Protection varies according to IP Rating. See below or refer to llialighting.com/resources for more information.*

IMAGING
SEMI-UNIFORM
UNIFORM

IP20, uncoated - Dry Location

IP65, silicone covered - Wet Location – Limited protection from water ingress. Not suitable for applications that may see pooling or standing water conditions. Not suitable for submersion.

LLI ARCHITECTURAL LIGHTING

THIN EXTRUSION + LED TAPELIGHT

ORDERING GUIDE (CONTINUED)

5. LENGTH

5. LENGTH
48IN

Enter overall extrusion length in inches. Maximum assembled length is 94in. Lengths over 94in are made with multiple sections, shipped unassembled. Overall Extrusion+LED tapelight length will be rounded down based on nearest LED tapelight cut point.

Length varies - see drawings

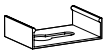
6. MOUNTING (OPTIONAL)

6. MOUNTING
[blank]

Default [blank] - Standard Clip

ADJ Adjustable Clip

STANDARD MOUNTING CLIP INCLUDED UNLESS OTHERWISE SPECIFIED



0.75" W x 0.34" H x 0.50" L

ADJUSTABLE MOUNTING CLIP



0.75" W x 1.1" H x 0.67"L

7-9. POWER FEED (OPTIONAL)

7. LEAD TYPE	8. LEAD LENGTH	9. FEED TYPE
[blank]	[blank]	[blank]

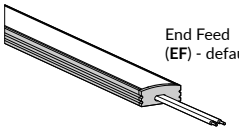
Default [blank] - 48" hard wire end feed (PWR48EF)

PWR Hard wire
MBC* Male barrel
FBC* Female barrel

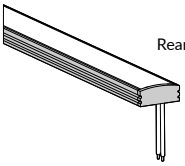
Enter desired wire length in inches.

EF End Feed
RF Rear Feed

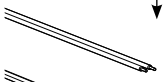
STANDARD 48" HARD WIRE END FEED INCLUDED UNLESS OTHERWISE SPECIFIED



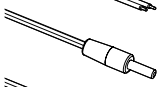
End Feed (**EF**) - default



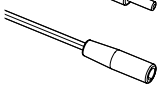
Rear Feed (**RF**)



Hard wire, no connector - default (**PWR**)



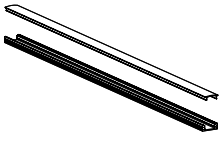
Male barrel connector (**MBC**)*



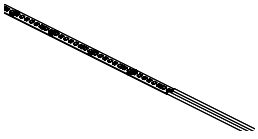
Female barrel connector (**FBC**)*

*Barrel connectors not compatible with RGB, RGB(W), or Tunable White tapelights.

WHAT'S INCLUDED



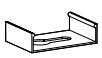
EXTRUSION WITH LENS



LED TAPELIGHT WITH POWER FEED



ENDCAPS



MOUNTING CLIPS

LLI ARCHITECTURAL LIGHTING

THIN EXTRUSION + LED TAPELIGHT

LUMEN OUTPUT MULTIPLIERS (FOR ESTIMATING DELIVERED LUMENS, FROSTED LEN ONLY)

COLOR TEMPERATURE	LUMEN MULTIPLIER
2200K	0.8
2700K	0.9
3000K	1
3500K	1.1
4200K	1.2
5200K	1.25

IP RATING	LUMEN MULTIPLIER
IP20	1
IP65	0.9

FINISH	LUMEN MULTIPLIER
Silver Anodized	1
Black Anodized	0.9
White Powder Coat	1.1

EXAMPLE: White Powder Coat Extrusion, 2.2W, IP65, 5200K

(Output @ 30K) x (Color temperature lumen multiplier) x (IP rating lumen multiplier) x (Finish lumen multiplier) = Estimated delivered lm/ft

193 lm/ft	*x*	*1.25*	*x*	*0.9*	*x*	*1.1*	=	*239 lm/ft*

PHOTOMETRY

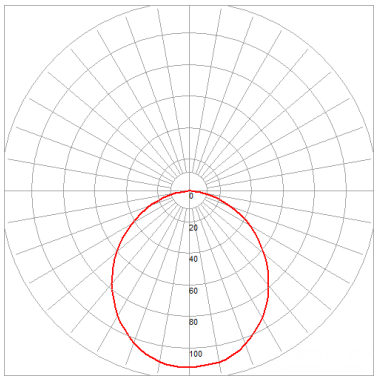
LLI-THN-SF-4.4W-30K-24V*	
POWER (W/ft)	4.4W
OUTPUT (lm/ft)	296 lm/ft
COLOR TEMPERATURE	3000K
BEAM SPREAD	105°
EFFICACY (lm/W)	68 lm/W

BEAM SPREAD

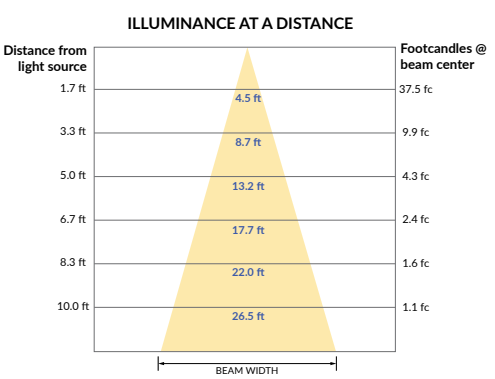
105°



POLAR CHART



CONICAL CHART



**Information for other options available upon request. IES files for extrusion+tapelight available upon request.*

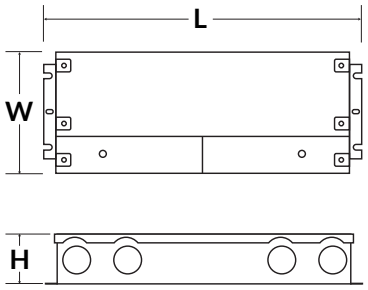
LLI ARCHITECTURAL LIGHTING

POWER SUPPLIES SOLD SEPARATELY

DIMMABLE ELECTRONIC 0-10V

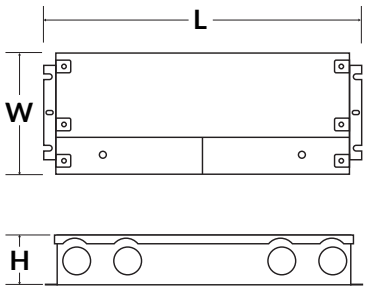
Optimal performance dims to 0%.*

PART NUMBER	CAPACITY	INPUT	OUTPUT	CLASS	LOCATION	L	W	H
LLI-PS-DE010-030W-24V-KO	30W	120V or 277V	24V	CLASS 2	IP66 WET	6.5”	3.6”	1.6”
LLI-PS-DE010-060W-24V-KO	60W	120V or 277V	24V	CLASS 2	IP66 WET	7.4”	3.6”	1.6”
LLI-PS-DE010-096W-24V-KO	96W	120V or 277V	24V	CLASS 2	IP66 WET	8.7”	3.7”	1.7”
LLI-PS-DE010-192W-24V-CL2-KO	2x96W	120V or 277V	24V	CLASS 2	IP66 WET	10.9”	4.3”	1.9”
LLI-PS-DE010-200W-24V-KO	200W	120V or 277V	24V	CLASS 1	IP66 WET	10.2”	4.1”	1.8”
LLI-PS-DE010-288W-24V-CL2-KO	3x96W	120V or 277V	24V	CLASS 2	IP66 WET	11.9”	4.3”	1.9”
LLI-PS-DE010-300W-24V-KO	300W	120V or 277V	24V	CLASS 1	IP66 WET	10.9”	4.3”	1.8”



NON-DIMMABLE ELECTRONIC

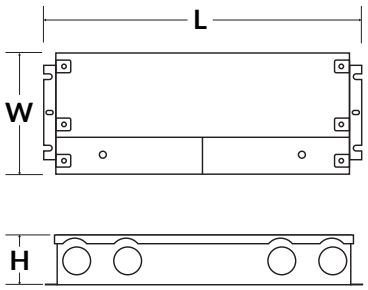
PART NUMBER	CAPACITY	INPUT	OUTPUT	CLASS	LOCATION	L	W	H
LLI-PS-NDE-030W-24V-KO	30W	100-277V	24V	CLASS 2	IP66 WET	6.5”	3.5”	1.02”
LLI-PS-NDE-060W-24V-KO	60W	100-277V	24V	CLASS 2	IP66 WET	7.4”	3.5”	1.2”
LLI-PS-NDE-096W-24V-KO	96W	100-277V	24V	CLASS 2	IP66 WET	8.7”	3.7”	1.7”
LLI-PS-NDE-192W-24V-CL2-KO	2x96W	100-277V	24V	CLASS 2	IP66 WET	10.9”	4.1”	1.9”
LLI-PS-NDE-200W-24V-KO	200W	100-277V	24V	CLASS 1	IP66 WET	10.3”	4.1”	1.8”
LLI-PS-NDE-288W-24V-CL2-KO	3x96W	100-277V	24V	CLASS 2	IP66 WET	11.9”	4.1”	1.9”
LLI-PS-NDE-300W-24V-KO	300W	100-277V	24V	CLASS 1	IP66 WET	10.9”	4.3”	1.8”



DIMMABLE ELECTRONIC FLICKER-FREE

Optimal performance dims to 2-5%.

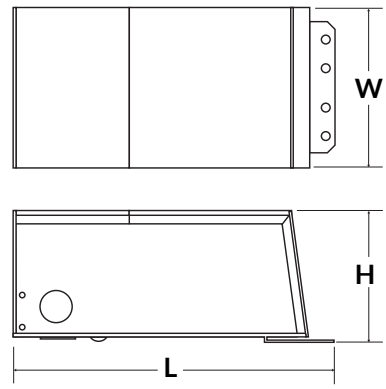
PART NUMBER	CAPACITY	INPUT	OUTPUT	CLASS	LOCATION	L	W	H
LLI-PS-UDEFF-030W-24V-KO	30W	110-277V	24V	CLASS 2	IP66 WET	6.5”	3.6”	1.0”
LLI-PS-UDEFF-060W-24V-KO	60W	110-277V	24V	CLASS 2	IP66 WET	7.4”	3.6”	1.0”
LLI-PS-UDEFF-096W-24V-KO	96W	110-277V	24V	CLASS 2	IP66 WET	8.7”	3.7”	1.6”
LLI-PS-UDEFF-192W-24V-CL2-KO	2x96W	110-277V	24V	CLASS 2	IP66 WET	10.9”	4.3”	1.9”
LLI-PS-UDEFF-200W-24V-KO	200W	110-277V	24V	CLASS 1	IP66 WET	10.2”	4.1”	1.8”
LLI-PS-UDEFF-288W-24V-CL2-KO	3x96W	110-277V	24V	CLASS 2	IP66 WET	11.9”	4.3”	1.9”
LLI-PS-UDEFF-300W-24V-KO	300W	110-277V	24V	CLASS 1	IP66 WET	11.0”	4.3”	1.8”



DIMMABLE MAGNETIC

Optimal performance dims to 5-10%.*

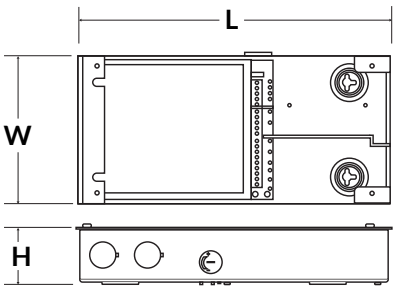
PART NUMBER	CAPACITY	INPUT	OUTPUT	CLASS	LOCATION	L	W	H
LLI-PS-DM-020W-24V-KO	20W	120V or 277V	24V	CLASS 2	NEMA 3R WET	7.38”	2.11”	1.60”
LLI-PS-DM-040W-24V-KO	40W	120V or 277V	24V	CLASS 2	NEMA 3R WET	7.38”	2.11”	1.60”
LLI-PS-DM-060W-24V-KO	60W	120V or 277V	24V	CLASS 2	NEMA 3R WET	8.13”	3.93”	1.59”
LLI-PS-DM-100W-24V-KO	100W	120V or 277V	24V	CLASS 2	NEMA 3R WET	8.13”	3.93”	1.59”
LLI-PS-DM-150W-24V-KO	150W	120V or 277V	24V	CLASS 1	NEMA 3R WET	8.79”	4.15”	3.41”
LLI-PS-DM-200W-24V-KO	200W	120V or 277V	24V	CLASS 1	NEMA 3R WET	8.79”	4.15”	3.41”
LLI-PS-DM-300W-24V-KO	300W	120V or 277V	24V	CLASS 1	NEMA 3R WET	8.79”	4.15”	3.41”
LLI-PS-DM-300W-24V-CL2-KO	6 x 50W	120V or 277V	24V	CLASS 2	NEMA 3R WET	10.29”	5.69”	3.43”
LLI-PS-DM-600W-24V-KO	2 x 300W	120V or 277V	24V	CLASS 1	NEMA 3R WET	10.29”	6.79”	4.68”



LUTRON HI-LUME PREMIER 0.1% DIMMABLE ELECTRONIC

Soft-on, Fade-to-Black, continuous flicker-free dimming from 100% to 0.1.

PART NUMBER	CAPACITY	INPUT	OUTPUT	CLASS	LOCATION	L	W	H
L3D0-96W24V-U	96W	120-277V	24V	CLASS 2	IP20 DRY	10.5”	5.5”	2.0”



Performance can be affected by driver loading and dimmer type.

LLI ARCHITECTURAL LIGHTING

CONTROLS (SOLD SEPARATELY)

Click here or visit www.llialighting.com/C/23/controls for a summary of available options:

- RF Decoders
- RF Controls
- DMX Decoders
- DMX Controls

Project		Catalog #		Type	
Prepared by		Notes		Date	



HALO

HU30M

Modular High Performance LED Under Cabinet

Typical Applications
Residential • Commercial

Interactive Menu

- Order Information page 2
- Product Specifications page 4
- Product Warranty

Product Features

5 seleCCTable colors · dim-to-warm option included · Can be used for IECC International Energy Conservation Code High Efficacy Compliance · ENERGY STAR · UL CERTIFIED SAFETY · Efficiency Standards T24 California Title 24 Residential and Non-Residential Compliant

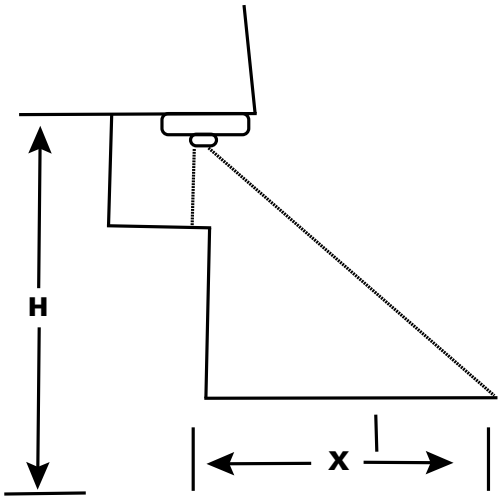
Top Product Features

- 5 selectable color temperatures: 2700K, 3000K, 3500K, 4000K and 5000K, 90 CRI
- Dim-To-Warm range: 2700K to 1800K (120V only)
- Field installable modular PIR Motion sensor accessory adds convenience and energy savings
- Field installable modular USB-A accessory port charges smart devices
- Universal voltage operates at 120V - 277V
- Smooth, continuous (ELV/TRIAC) dimming down to 5% at 120V with compatible dimmers
- 3/4” Sleek profile and even light distribution with low glare optics

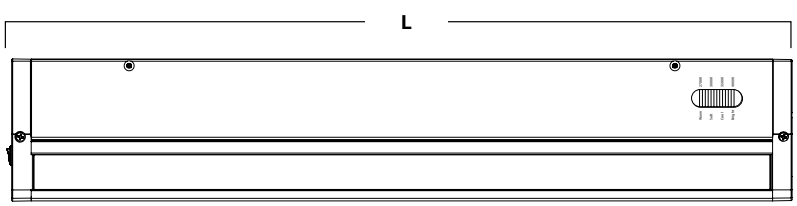
Dimensional and Mounting Details

Mounting Height H (ft)	Maximum PIR Detection Distance[Δ] X (ft)
2	3.5
4	5.7
6	6.5

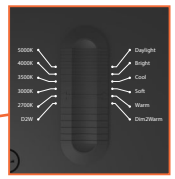
[Δ] Actual detection distance may vary based on multiple factors including but not limited to angle of moving object and reflectivity of surrounding surfaces. Table is provided for guidance purposes only.



HALO HU30M





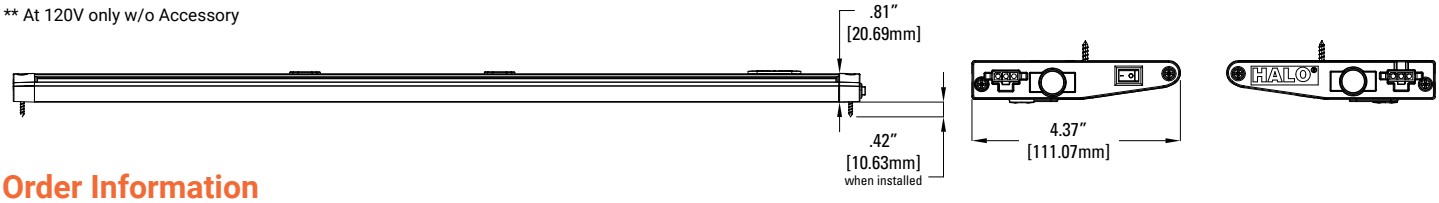


5 SeleCCTable CCT and Dim-To-Warm Switch

Size Description	9 in. Nominal	18 in. Nominal	24 in. Nominal	36 in. Nominal	48 in. Nominal
Length "L"	8.98"[228.1mm]	16.55"[420.4mm]	23.98"[609.1mm]	32.44"[824mm]	47.18"[1,198.4mm]
Wattage*	3.6	6.8	9.4	12.7	17.3
Lumens*	245	490	670	915	1275
Efficacy - LPW*	68	72	71	72	74
Nominal Lumens/ft	327	327	335	305	319

	HU30M Series
Power Factor**	>0.98
THD**	<20%
Color Rendering Index (CRI)	>90

* At factory setting of 3000K for white fixtures, check Photometric data for individual specifications
** At 120V only w/o Accessory



Order Information

Sample number: HU30MSCTD24P: 24" White, Dimmable HU30M fixture, with 5 Selectable CCT and Dim-To-Warm

Family	Configuration[1]/ Color Temp	Length	Finish
HU30M = Halo Modular Premium Under Cabinet	**SCTD=** SeleCCTable CCT with Dim2Warm	**09=** 9 inch [1] **18=** 18 inch [2] **24=** 24 inch **36=**36 inch **48=** 48 inch	**P=** White **MB=** Matte Black
	Notes Default factory setting= 3000K	**Notes** [1] Not field upgradable with PIR or USB. [2] Field upgradable with only one of the modular accessories (either PIR or USB, not both).	

Modular Accessories (ordered separately)*
HU30MUNVUP= USB-A Module, White **HU30MUNVMSP**= Motion Sensor Module, White **HU30MUNVUMB**= USB-A module, Matte Black **HU30MUNVMSMB**= Motion Sensor Module, Matte Black

* Accessories are field-installable inside the fixture and will not change the overall fixture dimension. See installation instructions for details

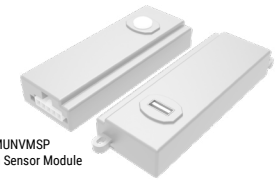
Compatibility of Modular Accessories based on fixture length**		
	PIR Sensor	USB-A Module
9 Inch	No	No
18 Inch	PIR Sensor Or USB-A Module	
24 Inch	Yes	Yes
36 Inch	Yes	Yes
48 Inch	Yes	Yes

** Modular Acessories need to be ordered separately from the standard fixture and are field-installable



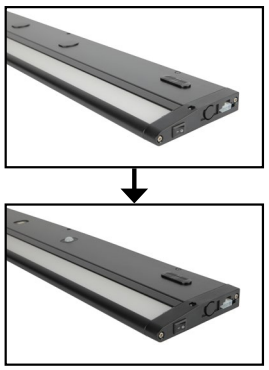
HU30MUNVMSMB
Motion Sensor Module

HU30MUNVUMB
USB-A Module



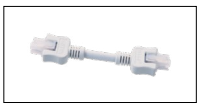
HU30MUNVMSP
Motion Sensor Module

HU30MUNVUP
USB-A Module

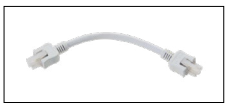


24" Fixture with USB-A port and PIR module installed

Connectors & Accessories



HU101
3" Daisy Chain Connector



HU102
6" Daisy Chain Connector



HU1010
12" Daisy Chain Connector



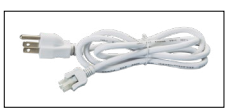
HU1011
18" Daisy Chain Connector



HU103
24" Daisy Chain Connector



HU104
120" Daisy Chain Connector



HU115
48" Power Cord - 120V only



HU109
Splice Box

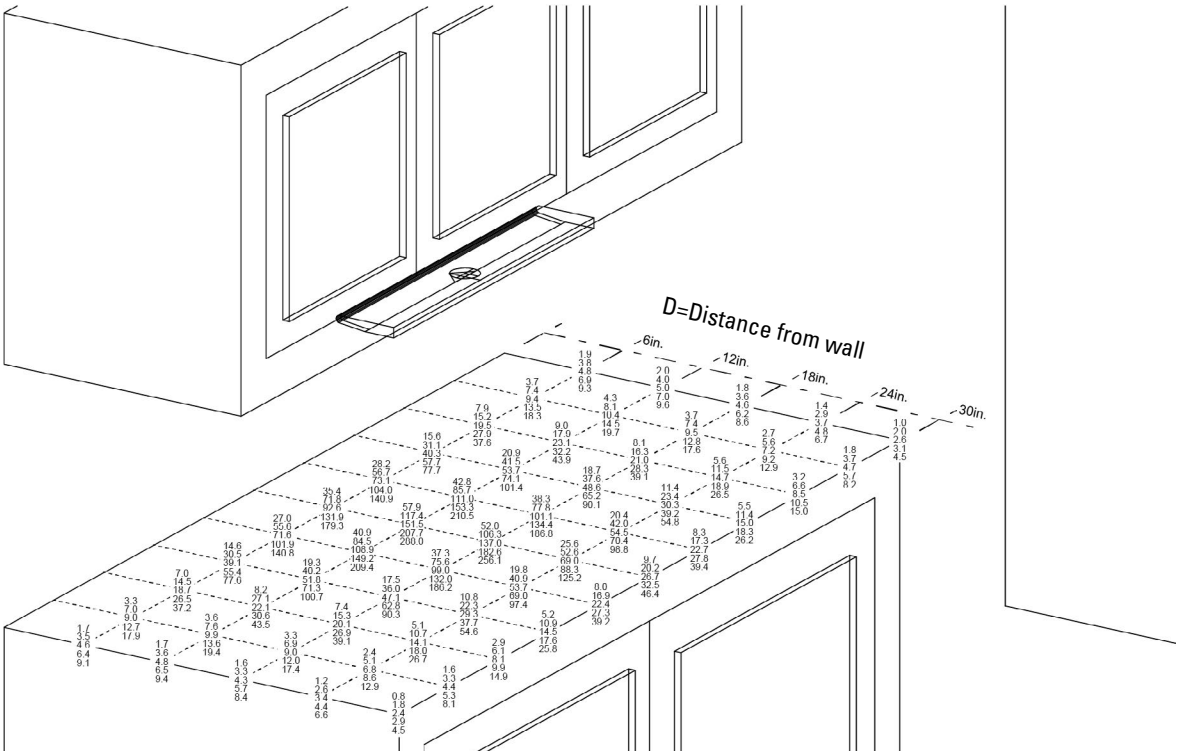


HU107
1-1/2" Male-to-Male Connector

Finish: P = White; **MB** = Matte Black

Example: HU101P = 3" Daisy Chain Connector, White

HALO HU30M



15" Mounting Height
Top Number Report - HU30MSCTD09P
Second Number Report - HU30MSCTD18P
Third Number Report - HU30MSCTD24P
Fourth Number Report - HU30MSCTD36P
Bottom Number Report - HU30MSCTD48P

Width												
30in	24in	18in	12in	6in	0in	6in	12in	18in	24in	30in	D	
1.7	3.3	7.0	14.6	27.0	35.4	28.2	15.6	7.9	3.7	1.9		
3.5	7.0	14.5	30.5	55.6	71.8	56.7	31.1	15.2	7.4	3.8		
4.6	9.0	18.7	39.1	71.6	92.6	73.1	40.3	19.5	9.4	4.8	6in	
6.4	12.7	26.5	55.4	101.9	131.9	104.0	57.7	27.9	13.5	6.9		
9.1	17.9	37.2	77.6	140.8	179.3	140.9	77.7	37.6	18.3	9.3		
1.7	3.6	8.2	19.3	40.9	57.9	42.8	20.9	9.0	4.3	2.0		
3.6	7.6	27.1	40.2	84.5	117.4	85.7	41.5	17.9	8.1	4.0		
4.8	9.9	22.1	51.8	108.9	151.5	111.0	53.7	23.1	10.4	5.0	12in	
6.5	13.6	30.6	71.3	149.2	207.7	153.3	74.1	32.2	14.5	7.0		
9.4	19.4	43.5	100.7	209.4	288.0	210.5	101.4	43.9	19.7	9.6		
1.6	3.3	7.4	17.5	37.3	52.0	38.3	18.7	8.1	3.7	1.8		Length
3.3	6.9	15.3	36.0	75.6	106.3	77.8	37.6	16.3	7.4	3.6		
4.3	9.0	20.1	47.1	99.0	137.0	101.1	48.6	21.0	9.5	4.6	18in	
5.7	12.0	26.9	62.8	132.0	182.6	134.4	65.2	28.3	12.8	6.2		
8.4	17.4	39.1	90.3	186.2	256.1	186.8	90.1	39.1	17.6	8.6		
1.2	2.4	5.1	10.8	19.8	25.6	20.4	11.4	5.6	2.7	1.4		
2.6	5.1	10.7	22.3	40.9	52.6	42.0	23.4	11.5	5.6	2.9		
3.4	6.8	14.1	29.3	53.7	69.0	54.5	30.3	14.7	7.2	3.7	24in	
4.4	8.6	18.0	37.7	69.0	88.3	70.4	39.2	18.9	9.2	4.8		
6.6	12.9	26.7	54.6	97.4	125.2	98.8	54.8	26.5	12.9	6.7		
0.8	1.6	2.9	5.2	8.0	9.7	8.3	5.5	3.2	1.8	1.0		
1.8	3.3	6.1	10.9	16.9	20.2	17.3	11.4	6.6	3.7	2.0		
2.4	4.4	8.1	14.5	22.4	26.7	22.7	15.0	8.5	4.7	2.6	30in	
2.9	5.3	9.9	17.6	27.3	32.5	27.8	18.3	10.5	5.7	3.1		
4.5	8.1	14.9	25.8	39.2	46.4	39.4	26.2	15.0	8.2	4.5		

18" Mounting Height
Top Number Report - HU30MSCTD09P
Second Number Report - HU30MSCTD18P
Third Number Report - HU30MSCTD24P
Fourth Number Report - HU30MSCTD36P
Bottom Number Report - HU30MSCTD48P

Width											
30in	24in	18in	12in	6in	0in	6in	12in	18in	24in	30in	D
2.1	4	7.7	14.4	23.7	29.2	24.6	15.3	8.4	4.4	2.4	
4.5	8.4	16	30	48.5	59.4	49.4	30.8	16.5	8.8	4.8	
5.8	10.7	20.6	38.4	62.6	76.7	63.9	39.6	21.4	11.3	6.1	6in
8.1	15.1	29	54.1	88.1	107.8	89.9	56.1	30.3	16	8.7	
11.5	21.3	40.8	75.8	122.2	147.2	122.5	76.2	41	21.7	11.7	
2.2	4.3	8.8	17.8	31.7	40.8	33.2	19.1	9.6	4.8	2.5	
4.7	9	18.3	37	65.9	83	66.6	37.7	19.1	9.5	5	
6.1	11.7	23.7	47	84.4	107.2	86	49.1	24.6	12.3	6.4	12in
8.3	16.1	32.5	65.2	115.2	146.1	117.8	67.6	34.1	17	8.9	
11.9	23	46.3	92.4	162	203	162.4	92.7	46.6	23.2	12.1	
2	4	8	16.3	29	36.9	29.6	17.2	8.7	4.4	2.3	
4.3	8.2	16.6	33.6	59.2	74.9	60.4	34.7	17.5	8.8	4.6	
5.6	10.8	21.7	43.7	76.9	96.9	78.2	44.8	22.6	11.3	5.9	18in
7.4	14.4	29.1	58.3	102.5	129.4	104.2	60.3	30.4	15.2	7.9	
10.8	20.9	41.9	83.2	144.2	181	144.6	83.4	42	21	10.9	
1.6	3.1	5.9	10.9	17.6	21.4	18.1	11.4	6.2	3.4	1.8	
3.4	6.4	12.1	22.5	36.5	44.4	37	23.4	12.9	6.9	3.8	
4.5	8.4	15.9	29.5	47.5	57.6	48.3	30.3	16.5	8.8	4.8	24in
5.8	10.8	20.6	38.4	61.8	74.4	62.8	39.5	21.5	11.5	6.3	
8.7	16	30.1	54.9	87.1	105.1	87.9	55.2	29.9	16	8.7	
1.2	2	3.6	5.9	8.4	10	8.8	6.2	3.8	2.3	1.3	
2.5	4.3	7.5	12.3	17.8	20.6	18.2	12.9	8	4.7	2.8	
3.3	5.7	9.9	16.3	23.5	27	23.7	16.7	10.3	6	3.5	30in
4.1	7.1	12.3	20.3	29.3	33.7	29.7	21	13	7.5	4.4	
6.2	10.7	18.2	29.3	41.7	48.1	41.9	29.8	18.4	10.7	6.2	

Product Specifications

Even Light Distribution

- Specialized optical system consisting of tightly clustered proximity phosphor LEDs, advanced optical chamber coatings and lens materials resulting in soft illumination with high efficiency.
- These fixtures are ideal for task lighting over glossy surfaces with no distracting shadow patterns.

Color Temperature

6 Position external selector which includes a 5 CCT SeleCCTable color temperature switch that allows users to choose between 2700K, 3000K, 3500K, 4000K and 5000K, and an additional Dim-To-Warm setting (D2W range- 2700K to 1800K at 120V), for the customer's lighting need.

PIR Motion Sensor Module

- Offered as a field installable modular accessory, the PIR technology based motion sensor allows for the fixture on/off to be managed based on movement detection. The HU30M PIR sensor works as an occupancy/vacancy sensor which activates the fixture when motion is detected and turns off the fixture when no motion is detected for 8 continuous minutes. See table on Page 1 for detection distances.

USB-A Module

- The USB-A port is offered as a field installable modular accessory. The USB output supplies 5V, 2A and is useful for charging many smart devices and accessories requiring a USB-A input.

Wiring Flexibility

User can power a fixture with multiple options: (See installation instructions for more details)

- Flexible conduit or romex can be used directly to either end of back of any size fixture to power the fixtures. Conduit connector and romex strain relief hardware are included with each fixture.
- Plug in cord (sold separately) can be utilized to link additional fixtures to the circuit. (120V only)

User can wire multiple fixtures with different options: (See installation instructions for more details)

- Wiring multiple fixtures can be done using flexible conduit or romex directly to either end of back of any size fixture. Conduit connector and romex strain relief hardware are included with each fixture.
- Plug in connectors (sold separately) can be utilized to link additional fixtures to the circuit.
- Link any combination of fixtures up to 440W total load using available wiring options.

Durable Low Profile Housing

Extruded aluminum housing and color matched end caps with a sleek over all height of 3/4".

Mounting

Each unit is secured directly to the mounting surface with just two fasteners keeping installation costs and efforts low. Can be mounted in horizontal and vertical orientations.

Optional Accessories

- PIR Motion sensor, USB-A port and and optional splice box are accessories offered for the HU30M series. The optional splice box has a connection port on each side to allow for runs in either or both directions. Includes Romex/ 1/2" conduit connector.
- Various connector cable options and lengths provide flexibility of mounting location.

Finish Options

Fixtures and accessories are available in both White (P) and Matte Black (MB) finishes.

Electronic Driver & Dimming

- Universal Voltage (120-277V, 50/60Hz) Electronic driver provides flicker free light output and noise free operation.
- Universal Voltage electronic driver is controlled with an integral on/off switch.
- Designed for continuous dimming (ELV or TRIAC) down to 5% at 120V with compatible dimmers.

Compliance & Certifications

- UL Certified
- Can be used to meet IECC, ASHRAE commercial and residential standards
- FCC rated driver
- Can be used for State of California Title 24 high efficacy LED compliance under JA8
- Damp location listed
- Closet rated
- ENERGY STAR® certified

Factory Defaults

The fixtures will be set to the following default where applicable:

- CCT: 3000K

Warranty

Five-year limited warranty, consult website for details. www.cooperlighting.com

* See our website for dimming guidance information. www.cooperlighting.com

Cooper Lighting Solutions
1121 Highway 74 South
Peachtree City, GA 30269
P: 770-486-4800
www.cooperlighting.com

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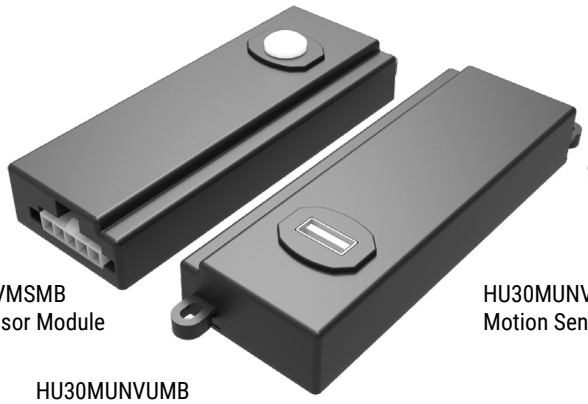
Energy Data

Catalog	CCT (K)	Lumen	Efficacy (lm/W)	Watt (W)	PF	CCT tested (K)	CRI	R9	Duv	SDCM
HU30MSCTD09MB (9' BLK Version)	2700	250.89	76.03	3.3	0.983	2755	94.9	66.3	-0.0015	2.7
	3000	251.90	76.33	3.3	0.983	3074	96.0	75.9	-0.0030	4.3
	3500	252.71	76.58	3.3	0.983	3490	96.4	83.2	-0.0032	4.2
	4000	253.11	76.70	3.3	0.983	4096	96.5	87.1	-0.0018	3.8
	5000	252.81	76.84	3.29	0.983	5211	94.7	79.1	0.0033	3.1
HU30MSCTD09D9SP (9"" White Version)	2700	256.54	74.36	3.45	0.982	2748	95.5	73.3	0.0008	1.3
	3000	258.36	74.89	3.45	0.982	3040	96.7	81.4	-0.0010	1.4
	3500	259.48	75.21	3.45	0.982	3416	97.2	87.9	-0.0019	2.7
	4000	260.89	75.62	3.45	0.982	3967	97.3	91.1	-0.0011	2.3
	5000	261.60	75.83	3.45	0.982	4977	95.2	83.8	0.0027	1.2
HU30MSCTD18MB (18"" Black Version)	2700	513.60	77.82	6.6	0.986	2725	95.1	68.6	-0.0022	2.8
	3000	519.50	78.71	6.6	0.986	3030	96.0	77.7	-0.0036	4.4
	3500	524.90	79.53	6.6	0.986	3434	96.5	85.0	-0.0038	4.6
	4000	530.20	80.33	6.6	0.986	4034	96.7	88.8	-0.0023	3.7
	5000	536.70	81.20	6.61	0.986	5174	94.9	79.7	0.0031	2.6
HU30MSCTD18P (18"" White Version)	2700	495.41	75.06	6.6	0.987	2820	94.1	62.8	-0.0003	4.4
	3000	505.00	76.40	6.61	0.987	3148	95.0	70.1	-0.0024	5.4
	3500	516.11	78.08	6.61	0.987	3566	95.4	75.5	-0.0033	5.2
	4000	528.03	79.76	6.62	0.987	4162	95.2	77.6	-0.0027	5.5
	5000	544.29	82.22	6.62	0.987	5211	93.9	70.1	0.0007	3.2
HU30MSCTD24MB (24"" Black Version)	2700	664.43	74.07	8.97	0.964	2757	94.4	63.1	-0.0016	2.8
	3000	668.68	74.46	8.98	0.964	3011	95.5	71.2	-0.0031	3.9
	3500	672.93	74.69	9.01	0.964	3357	96.2	78.5	-0.0038	5.1
	4000	677.18	74.91	9.04	0.964	3901	96.5	83.8	-0.0031	4.6
	5000	678.16	74.85	9.06	0.965	5029	94.4	76.6	0.0013	0.7
HU30MSCTD24P (24"" White Version)	2700	670.28	73.25	9.15	0.964	2739	93.8	60.5	0.0002	0.7
	3000	681.75	74.51	9.15	0.964	3038	94.7	68.0	-0.0018	2.4
	3500	692.72	75.62	9.16	0.965	3421	95.1	74.1	-0.0028	3.5
	4000	702.79	76.64	9.17	0.965	3975	94.8	77.7	-0.0023	3.5
	5000	715.85	78.15	9.16	0.965	4963	92.5	72.8	0.0007	1.7
HU30MSCTD36MB (36"" Black Version)	2700	920.96	74.88	12.3	0.971	2754	94.6	64.3	-0.0017	2.8
	3000	925.68	75.14	12.32	0.971	3019	95.7	72.5	-0.0032	4.0
	3500	929.16	75.36	12.33	0.971	3375	96.4	79.9	-0.0039	5.0
	4000	933.16	75.56	12.35	0.971	3929	96.6	84.9	-0.0032	4.4
	5000	935.01	75.46	12.39	0.972	5059	94.6	77.4	0.0014	0.8
HU30MSCTD36P (36"" White Version)	2700	920.10	74.02	12.43	0.968	2732	93.8	61.0	-0.0001	0.4
	3000	931.90	74.79	12.46	0.969	3022	94.8	68.5	-0.0020	2.6
	3500	947.30	75.97	12.47	0.969	3397	95.2	74.6	-0.0030	4.0
	4000	963.70	77.22	12.48	0.969	3942	94.9	78.2	-0.0026	3.8
	5000	984.20	78.80	12.49	0.969	4941	92.5	73.2	0.0006	2.0
HU30MSCTD48MB (48"" Black Version)	2700	1266.04	76.73	16.5	0.983	2760	94.6	64.7	-0.0018	3.1
	3000	1274.22	77.09	16.53	0.983	3030	95.7	72.9	-0.0034	4.2
	3500	1279.57	77.32	16.55	0.983	3388	96.4	80.4	-0.0041	5.1
	4000	1286.24	77.58	16.58	0.983	3949	96.7	85.4	-0.0034	4.6
	5000	1287.85	77.49	16.62	0.983	5101	94.6	78.0	0.0011	1.5
HU30MSCTD48P (48"" White Version)	2700	1279.95	76.14	16.81	0.981	2745	93.8	61.1	0.0001	0.9
	3000	1301.60	77.38	16.82	0.981	3043	94.8	68.6	-0.0020	2.6
	3500	1393.88	82.87	16.82	0.981	3426	95.2	74.7	-0.0029	3.7
		1343.48	79.83	16.83	0.981	3981	94.9	78.3	-0.0025	3.7
	5000	1370.64	81.49	16.82	0.981	4975	92.5	73.3	0.0006	1.7

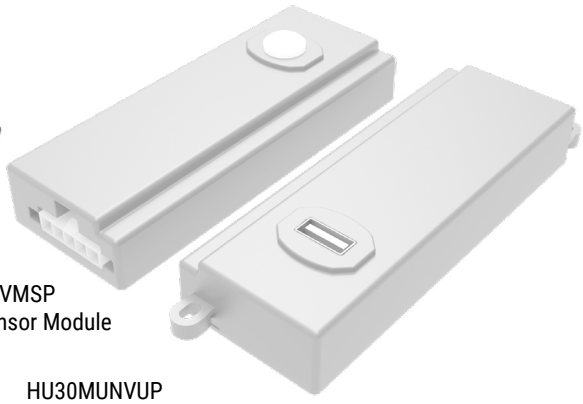
Cooper Lighting Solutions
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Connectors & Accessories



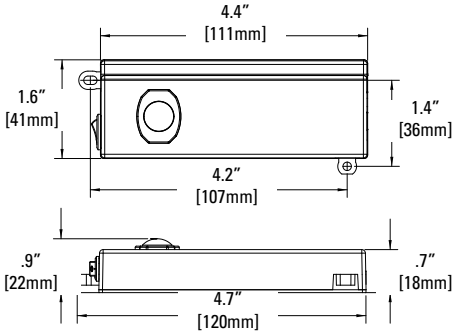
HU30MUNVMSMB
Motion Sensor Module

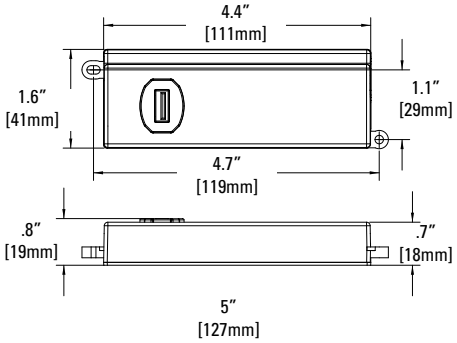


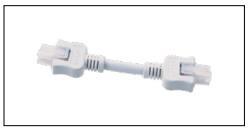
HU30MUNVMSP
Motion Sensor Module

HU30MUNVUMB
USB-A Module

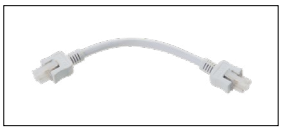
HU30MUNVUP
USB-A Module







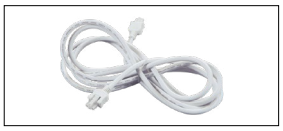
HU101
3" Daisy Chain Connector



HU102
6" Daisy Chain Connector



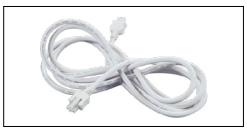
HU1010
12" Daisy Chain Connector



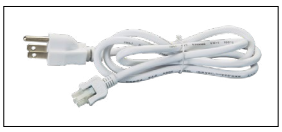
HU1011
18" Daisy Chain Connector



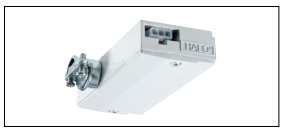
HU103
24" Daisy Chain Connector



HU104
120" Daisy Chain Connector



HU115
48" Power Cord - 120V only



HU109
Splice Box



HU107
1-1/2" Male-to-Male Connector

Finish: P = White; **MB** = Matte Black **Example:** HU101P = 3" Daisy Chain Connector, White

Project		Catalog #		Type	
Prepared by		Notes		Date	



McGraw-Edison

Impact Elite LED

Wall Mount Luminaire

Interactive Menu

- Ordering Information page 2
- Product Specifications page 2
- Energy and Performance Data page 3
- Control Options page 4

Product Certifications

Quick Facts

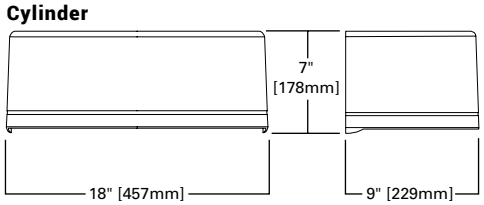
- 15 Optical Distributions
- Lumen packages range from 2,459 to 11,480 (20W - 95W)
- Efficacy up to 149 lumens per watt

Connected Systems

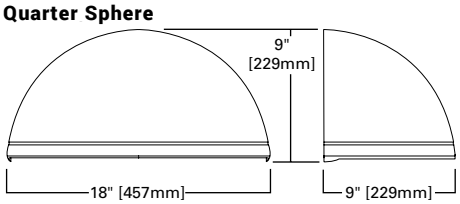
- WaveLinx PRO Wireless
- WaveLinx LITE Wireless
- Enlighted

Dimensional Details

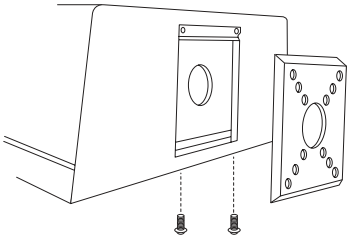
Cylinder



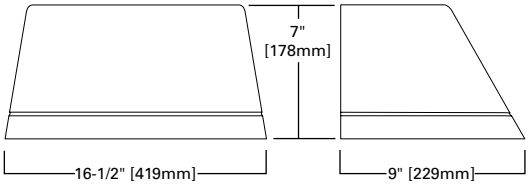
Quarter Sphere



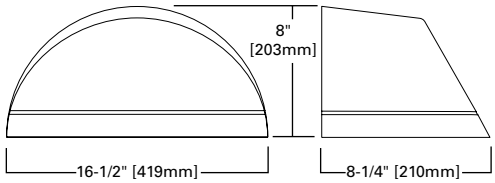
Hook -n- Lock



Trapezoid



Wedge



NOTES:
1. IDA Certified for 3000K CCT and warmer only.

Ordering Information

SAMPLE NUMBER: **ISC-SA1F-740-U-T3-BZ**

Product Family [1]	Light Engine		Color Temperature	Voltage	Distribution	Finish
	Configuration	Drive Current				
ISC=Impact Elite LED Small Cylinder **ISS**=Impact Elite LED Small Quarter Sphere **IST**=Impact Elite LED Small Trapezoid **ISW**=Impact Elite LED Small Wedge **BAA-ISC**=Impact Elite LED Small Cylinder Buy American Act Compliant [23] **TAA-ISC**=Impact Elite LED Small Cylinder Trade Agreements Act Compliant [23] **BAA-ISS**=Impact Elite LED Small Quarter Sphere Buy American Act Compliant [23] **TAA-ISS**=Impact Elite LED Small Quarter Sphere Trade Agreements Act Compliant [23] **BAA-IST**=Impact Elite LED Small Trapezoid Buy American Act Compliant [23] **TAA-IST**=Impact Elite LED Small Trapezoid Trade Agreements Act Compliant [23] **BAA-ISW**=Impact Elite LED Small Wedge Buy American Act Compliant [23] **TAA-ISW**=Impact Elite LED Small Wedge Trade Agreements Act Compliant [23]	**SA1**=1 Square (16 LED) **PA1**=1 Panel (24 LED) [26]	**A**=350mA **B**=450mA **C**=600mA **D**=800mA **E**=1000mA **F**=1200mA [2]	**722**=70CRI, 2200K **727**=70CRI, 2700K **730**=70CRI, 3000K **735**=70CRI, 3500K **740**=70CRI, 4000K **750**=70CRI, 5000K **760**=70CRI, 6000K **827**=80CRI, 2700K **830**=80CRI, 3000K **AMB**=Amber, 590nm [3, 4]	**U**=120-277V **1**=120V **2**=208V **3**=240V **4**=277V **8**=480V [5] **9**=347V	**SA1 Optics** **T2**=Type II **T3**=Type III **T4FT**=Type IV Forward Throw **T4W**=Type IV Wide **SL2**=Type II w/Spill Control **SL3**=Type III w/Spill Control **SL4**=Type IV w/Spill Control **SLL**=90° Spill Light Eliminator Left **SLR**=90° Spill Light Eliminator Right **RW**=Rectangular Wide Type I **PA1 Optics** **5WQ**=Type V Square Wide **T2R**=Type II **T2U**=Type II Urban **T3**=Type III **T4W**=Type IV Wide	**AP**=Grey **BZ**=Bronze **BK**=Black **DP**=Dark Platinum **GM**=Graphite Metallic **WH**=White **RALXX**=Custom Color [27]

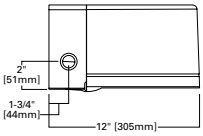
Options (Add as Suffix)	Controls and Systems Options (Add as Suffix)	Accessories (Order Separately)[24]
X=Driver Surge Protection (6kV) Only [17] **20K**=Series 20kV UL 1449 Surge Protective Device **CBP**=Battery Pack with Back Box, Cold Weather Rated [14, 15] **CBP-CEC**=Battery Pack with Back Box, Cold Weather Rated, CEC compliant [14] **HSS**=Factory Installed House Side Shield [16] **ULG**=Uplight Glow [6, 7, 25] **LCF**=Light Square Trim Plate Painted to Match Housing **TR**=Tamper Resistant Hardware **CC**=Coastal Construction [21] **HA**=50°C High Ambient [8] **AHD145**=After Hours Dim, 5 Hours, 50% [9] **AHD245**=After Hours Dim, 6 Hours, 50% [9] **AHD255**=After Hours Dim, 7 Hours, 50% [9] **AHD355**=After Hours Dim, 8 Hours, 50% [9]	**BPC**=Button Type Photocontrol (120, 208, 240 or 277V. Must Specify Voltage) **PR7**=NEMA 7-PIN Twistlock Photocontrol Receptacle [2, 6, 7] **SPB1**=Dimming Occupancy Sensor with Bluetooth Interface, <8' Mounting [12, 22] **SPB2**=Dimming Occupancy Sensor with Bluetooth Interface, 8'-20' Mounting [12, 22] **SPB4**=Dimming Occupancy Sensor with Bluetooth Interface, 21'-40' Mounting [12, 22] **MS/DIM-LXX**=Motion Sensor for Dimming Operation [7, 10, 11, 12] **LWR-LW**=Enlighted Wireless Sensor, Wide Lens for 8'-16' Mounting Height [6, 12, 13] **LWR-LN**=Enlighted Wireless Sensor, Narrow Lens for 16'-40' Mounting Height [6, 12, 13] **WLS2XX**=WaveLinx LITE, SR Driver, Dimming Motion and Daylight, Bluetooth Programmable, 7' - 15' Mounting [7,18,20] **WLS4XX**=WaveLinx LITE, SR Driver, Dimming Motion and Daylight, Bluetooth Programmable, 15' - 40' Mounting [7,18,20] **WPS2XX**=WaveLinx PRO, SR Driver, Dimming Motion and Daylight, WAC Programmable, 7' - 15' Mounting [7,18,20] **WPS4XX**=WaveLinx PRO, SR Driver, Dimming Motion and Daylight, WAC Programmable, 15' - 40' Mounting [7,18,20]	**MA1253**=10kV Circuit Module Replacement **MA1254-XX**=Thruway Back Box - Impact Elite Trapezoid **MA1255-XX**=Thruway Back Box - Impact Elite Cylinder **MA1256-XX**=Thruway Back Box - Impact Elite Quarter Sphere **MA1257-XX**=Thruway Back Box - Impact Elite Wedge **FSIR-100**=Wireless Configuration Tool for Occupancy Sensor **WOLC-7P-10A**=WaveLinx Outdoor Control Module (7-pin) [7, 19]

NOTES:

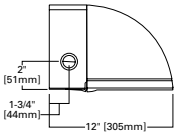
1. DesignLight Consortium® Qualified. Refer to www.designlights.org, Qualified Products List under Family Models for details.
2. Not available with ULG option.
3. Choose Drive Current "A" for Amber 590nm, which is provided at 500mA only.
4. Narrow-band 590nm +/- 5nm for wildlife and observatory use. Exact luminaire wattage available in IES files. Available with 5WQ, 5MQ, SL2, SL3 and SL4 distributions. Can be used with HSS option.
5. 480V not to be used with ungrounded or impedance grounded systems.
6. Not available with ISS or ISW.
7. Cannot be used in conjunction with other control options.
8. Suitable for 50°C provided no options other than motion sensor are included and driver output set to 1000mA or less.
9. Requires the use of photocontrol. Not available with 350mA drive current. See After Hours Dim supplemental guide for additional information.
10. Replace LXX with L08 (<8' mounting), L20 (8'-20' mounting) or L40W (21'-40' mounting.)
11. The FSIR-100 configuration tool is required to adjust parameters including high and low modes, sensitivity, time delay, cutoff and more. Consult your lighting representative at Cooper Lighting Solutions for more information.
12. Includes integral photocell.
13. Enlighted wireless sensors are factory installed and require network components in appropriate quantities.
14. Battery pack operating temperature of -20C to +40C. Operates downlight for 90-minutes.
15. Must specify 120V or 277V.
16. Not for use with 5NQ, 5MQ, 5WQ or RW optics. A black trim plate is used when HSS is selected.
17. Removes additional surge module.
18. Replace XX with sensor color (WH, BZ, or BK).
19. Requires PR7.
20. For WaveLinx applications, WAC Gateway required to enable field-configurability: Order WAC-PoE and WPOE-120 (10V to PoE injector) power supply if needed. Gateway not required for WaveLinx Lite Commercial (LC) applications.
21. Coastal construction finish salt spray tested to over 5,000-hours per ASTM B117, with a scribe rating of 9 per ASTM D1654.
22. Smart device with mobile application required to change system defaults. See controls section for details.
23. Only product configurations with these designated prefixes are built to be compliant with the Buy American Act of 1933 (BAA) or Trade Agreements Act of 1979 (TAA), respectively. Please refer to DOMESTIC PREFERENCES website for more information Components shipped separately may be separately analyzed under domestic preference requirements.
24. For BAA or TAA requirements, Accessories sold separately will be separately analyzed under domestic preference requirements. Consult factory for further information.
25. Only available in 3000K, 4000K or 5000K CCT.
26. Not available with motion sensor controls, including SPB, MS/DIM, LWR or WaveLinx.
27. Specify RAL number for Custom Color. Custom color matching available upon request. Consult your lighting representative at Cooper Lighting Solutions for more information.

Thruway Back Box

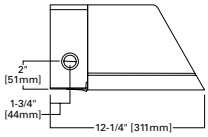
Cylinder



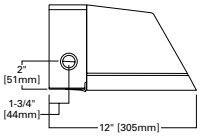
Quarter Sphere



Trapezoid



Wedge



Product Specifications

Construction

- Heavy-wall, die-cast aluminum housing and removable hinged door frame
- Optional tamper-resistant fasteners offer vandal resistant access
- IK10 impact rated

Optics

- High-efficiency injection-molded AccuLED optics technology
- 15 optical distributions
- IDA Certified (3000K CCT and warmer only)

Electrical

- Standard with 0-10V dimming
- Standard with Cooper Lighting Solutions proprietary circuit module designed to withstand 10kV of transient line surge
- Suitable for operation in -40°C to 40°C ambient environments. Optional 50°C high ambient (HA) configuration
- Suitable for operation in -40°C to 40°C ambient environments. Optional 50°C high ambient (HA) configuration.

Mounting

- Utilizes "Hook-N-Lock" mounting mechanism, securing to a gasketed and zinc plated mounting attachment
- Two black oxide coated Allen set screws concealed but accessible from below

Finish

- Super durable TGIC polyester powder coat paint, 2.5 mil nominal thickness
- RAL and custom color matches available
- Coastal Construction (CC) option available

Warranty

- Five year limited warranty, consult website for details. www.cooperlighting.com/legal

McGraw-Edison Impact Elite LED

Energy and Performance Data

View Impact Elite IES files

1 Light Square (SA)		Cylinder (ISC) and Quarter Sphere (ISS)						Trapezoid (IST) and Wedge (ISW)					
Drive Current (mA)		350	450	600	800	1000	1200	350	450	600	800	1000	1200
Power (Watts)	120 - 277V	20.1	25.4	34.2	45.2	58.2	66.0	20.1	25.4	34.2	45.2	58.2	66.0
Current (A)	120	0.17	0.22	0.29	0.38	0.48	0.56	0.17	0.22	0.29	0.38	0.48	0.56
	277V	0.09	0.10	0.13	0.17	0.21	0.25	0.09	0.10	0.13	0.17	0.21	0.25
Power (Watts)	347V or 480V	23.3	28.7	36.6	49.5	60.7	70.1	23.3	28.7	36.6	49.5	60.7	70.1
Current (A)	347V	0.07	0.08	0.11	0.15	0.18	0.21	0.07	0.08	0.11	0.15	0.18	0.21
	480V	0.05	0.06	0.08	0.11	0.13	0.16	0.05	0.06	0.08	0.11	0.13	0.16
Optics (4000K, 70 CRI)													
T2	Lumens	2,802	3,500	4,618	5,778	7,231	7,895	2,772	3,475	4,576	5,733	7,175	7,834
	BUG Rating	B1-U0-G1	B1-U0-G1	B1-U0-G1	B1-U0-G2	B1-U0-G2	B1-U0-G2	B1-U0-G1	B1-U0-G1	B1-U0-G1	B1-U0-G2	B1-U0-G2	B1-U0-G2
	Lumens Per Watt	139	138	135	128	124	120	138	137	134	127	123	119
T3	Lumens	2,778	3,470	4,578	5,729	7,169	7,827	2,731	3,424	4,508	5,648	7,069	7,718
	BUG Rating	B1-U0-G1	B1-U0-G1	B1-U0-G1	B1-U0-G2	B1-U0-G2	B1-U0-G2	B1-U0-G1	B1-U0-G1	B1-U0-G1	B1-U0-G2	B1-U0-G2	B1-U0-G2
	Lumens Per Watt	138	137	134	127	123	119	136	135	132	125	121	117
T4FT	Lumens	2,751	3,436	4,534	5,673	7,099	7,751	2,762	3,462	4,559	5,712	7,149	7,805
	BUG Rating	B1-U0-G1	B1-U0-G1	B1-U0-G1	B1-U0-G2	B1-U0-G2	B1-U0-G2	B1-U0-G1	B1-U0-G1	B1-U0-G1	B1-U0-G2	B1-U0-G2	B1-U0-G2
	Lumens Per Watt	137	135	133	126	122	117	137	136	133	126	123	118
T4W	Lumens	2,780	3,473	4,582	5,733	7,174	7,833	2,739	3,434	4,522	5,665	7,089	7,740
	BUG Rating	B1-U0-G1	B1-U0-G1	B1-U0-G2	B1-U0-G2	B1-U0-G2	B1-U0-G2	B1-U0-G1	B1-U0-G1	B1-U0-G2	B1-U0-G2	B1-U0-G2	B1-U0-G2
	Lumens Per Watt	138	137	134	127	123	119	136	135	132	125	122	117
SL2	Lumens	2,763	3,451	4,554	5,698	7,130	7,785	2,730	3,422	4,507	5,646	7,066	7,715
	BUG Rating	B1-U0-G1	B1-U0-G1	B1-U0-G1	B1-U0-G2	B1-U0-G2	B2-U0-G2	B1-U0-G1	B1-U0-G1	B1-U0-G1	B1-U0-G2	B1-U0-G2	B2-U0-G2
	Lumens Per Watt	137	136	133	126	123	118	136	135	132	125	121	117
SL3	Lumens	2,745	3,429	4,524	5,660	7,084	7,734	2,709	3,396	4,472	5,603	7,012	7,655
	BUG Rating	B1-U0-G1	B1-U0-G1	B1-U0-G1	B1-U0-G2	B1-U0-G2	B1-U0-G2	B1-U0-G1	B1-U0-G1	B1-U0-G1	B1-U0-G2	B1-U0-G2	B1-U0-G2
	Lumens Per Watt	137	135	132	125	122	117	135	134	131	124	120	116
SL4	Lumens	2,680	3,348	4,417	5,526	6,916	7,551	2,666	3,342	4,401	5,514	6,900	7,534
	BUG Rating	B1-U0-G1	B1-U0-G1	B1-U0-G1	B1-U0-G2	B1-U0-G2	B1-U0-G2	B1-U0-G1	B1-U0-G1	B1-U0-G1	B1-U0-G2	B1-U0-G2	B1-U0-G2
	Lumens Per Watt	133	132	129	122	119	114	133	132	129	122	119	114
SLL	Lumens	2,447	3,057	4,033	5,046	6,315	6,895	2,459	3,083	4,059	5,086	6,365	6,949
	BUG Rating	B1-U0-G1	B1-U0-G1	B1-U0-G1	B1-U0-G1	B1-U0-G2	B1-U0-G2	B1-U0-G1	B1-U0-G1	B1-U0-G1	B1-U0-G1	B1-U0-G2	B1-U0-G2
	Lumens Per Watt	122	120	118	112	109	104	122	121	119	113	109	105
RW	Lumens	2,883	3,601	4,751	5,945	7,440	8,123	2,818	3,533	4,652	5,828	7,294	7,964
	BUG Rating	B2-U0-G1	B2-U0-G1	B2-U0-G1	B3-U0-G1	B3-U0-G1	B3-U0-G1	B2-U0-G1	B2-U0-G1	B2-U0-G1	B3-U0-G1	B3-U0-G1	B3-U0-G1
	Lumens Per Watt	143	142	139	132	128	123	140	139	136	129	125	121

1 Light Panel (PA)		Cylinder (ISC) and Quarter Sphere (ISS)						Trapezoid (IST) and Wedge (ISW)					
Drive Current (mA)		350	450	600	800	1000	1200	350	450	600	800	1000	1200
Power (Watts)	120 - 277V	28.9	36.4	48.9	63.0	82.4	94.4	28.9	36.4	48.9	63.0	82.4	94.4
Current (A)	120V	0.24	0.31	0.41	0.53	0.69	0.79	0.24	0.31	0.41	0.53	0.69	0.79
	277V	0.11	0.14	0.18	0.23	0.30	0.34	0.11	0.14	0.18	0.23	0.30	0.34
Power (Watts)	347V or 480V	30.5	37.7	49.0	63.9	83.2	95.0	30.5	37.7	49.0	63.9	83.2	95.0
Current (A)	347V OR 480V	0.09	0.11	0.14	0.19	0.24	0.28	0.09	0.11	0.14	0.19	0.24	0.28
	480V	0.07	0.08	0.11	0.14	0.18	0.20	0.07	0.08	0.11	0.14	0.18	0.20
Optics (4000K, 70 CRI)													
T2R	Lumens	4,296	5,369	7,010	8,733	10,721	11,750	4,154	5,211	6,738	8,386	10,329	11,338
	BUG Rating	B1-U0-G1	B1-U0-G1	B1-U0-G2	B1-U0-G2	B1-U0-G2	B2-U0-G2	B1-U0-G1	B1-U0-G1	B1-U0-G2	B1-U0-G2	B1-U0-G2	B2-U0-G2
	Lumens Per Watt	149	147	143	139	130	124	144	143	138	133	125	120
T2U	Lumens	4,241	5,300	6,920	8,621	10,584	11,600	4,123	5,172	6,688	8,323	10,252	11,253
	BUG Rating	B1-U0-G1	B2-U0-G2	B2-U0-G2	B2-U0-G2	B3-U0-G3	B3-U0-G3	B1-U0-G1	B2-U0-G2	B2-U0-G2	B2-U0-G2	B3-U0-G3	B3-U0-G3
	Lumens Per Watt	147	146	142	137	128	123	143	142	137	132	124	119
T3	Lumens	4,193	5,240	6,842	8,524	10,464	11,468	4,079	5,117	6,616	8,235	10,143	11,133
	BUG Rating	B1-U0-G2	B1-U0-G2	B1-U0-G2	B2-U0-G2	B2-U0-G3	B2-U0-G3	B1-U0-G2	B1-U0-G2	B1-U0-G2	B2-U0-G2	B2-U0-G3	B2-U0-G3
	Lumens Per Watt	145	144	140	135	127	121	141	141	135	131	123	118
T4W	Lumens	4,165	5,205	6,796	8,467	10,394	11,392	4,083	5,122	6,623	8,243	10,152	11,144
	BUG Rating	B1-U0-G2	B1-U0-G2	B1-U0-G2	B2-U0-G3	B2-U0-G3	B2-U0-G3	B1-U0-G2	B1-U0-G2	B1-U0-G2	B2-U0-G3	B2-U0-G3	B2-U0-G3
	Lumens Per Watt	144	143	139	134	126	121	141	141	135	131	123	118
5WQ	Lumens	4,255	5,318	6,943	8,650	10,619	11,638	4,206	5,276	6,822	8,491	10,458	11,480
	BUG Rating	B3-U0-G1	B3-U0-G2	B3-U0-G2	B3-U0-G2	B4-U0-G3	B4-U0-G3	B3-U0-G1	B3-U0-G2	B3-U0-G2	B3-U0-G2	B4-U0-G2	B4-U0-G3
	Lumens per Watt	147	146	142	137	129	123	146	145	140	135	127	122

Lumen Maintenance (TM-21)

Drive Current	Ambient Temperature	25,000 hours*	50,000 hours*	60,000 hours*	100,000 hours**	Theoretical L70 hours**
Up to 1A	25°C	99.4%	99.0%	98.9%	98.3%	> 2.4M
	40°C	98.7%	98.3%	98.1%	97.4%	> 1.9M
	50°C	98.2%	97.2%	96.8%	95.2%	> 851,000
1.2A	25°C	99.4%	99.0%	98.9%	98.3%	> 2.4M
	40°C	98.5%	97.9%	97.7%	96.7%	> 1.3M

* Supported by IES TM-21 standards
** Theoretical values represent estimations commonly used; however, refer to the IES position on LED Product Lifetime Prediction, IES PS-10-18, explaining proper use of IES TM-21 and LM-80.

Lumen Multiplier

Ambient Temperature	Lumen Multiplier
10ºC	1.02
15ºC	1.01
25ºC	1.00
40ºC	0.99

Control Options

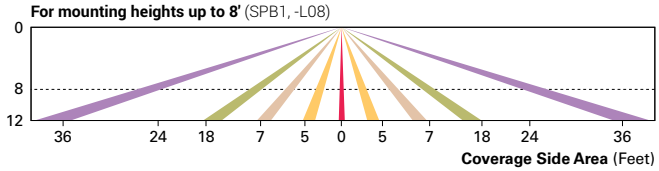
0-10V
This fixture is offered standard with 0-10V dimming driver(s).

Photocontrol (BPC and PR7)
Optional button-type photocontrol provides a flexible solution to enable “dusk-to-dawn” lighting by sensing light levels.

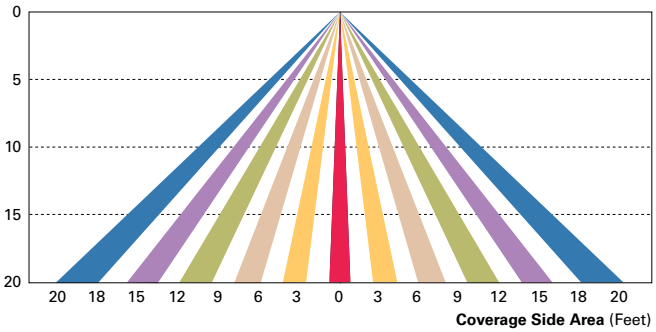
After Hours Dim (AHD)
This feature allows photocontrol-enabled luminaires to achieve additional energy savings by dimming during scheduled portions of the night. The dimming profile will automatically take effect after a “dusk-to-dawn” period has been calculated from the photocontrol input. Specify the desired dimming profile for a simple, factory-shipped dimming solution requiring no external control wiring. Reference the After Hours Dim supplemental guide for additional information.

Dimming Occupancy Sensor (SPB, MS/DIM-LXX)
These sensors are factory installed in the luminaire housing. When the SPB or MS/DIM sensor options are selected, the occupancy sensor is connected to a dimming driver and the entire luminaire dims when there is no activity detected. When activity is detected, the luminaire returns to full light output. The MS/DIM sensor is factory preset to dim down to approximately 50 percent power with a time delay of five minutes. SPB motion sensors require the Sensor Configuration mobile application by Wattstopper to change factory default dimming level, time delay, sensitivity and other parameters. Available for iOS and Android devices. The SPB sensor is factory preset to dim down to approximately 10% power with a time delay of five minutes. The MS/DIM occupancy sensors require the FSIR-100 programming tool to adjust factory defaults.

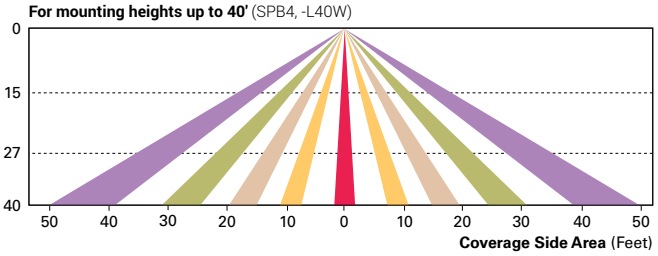
For mounting heights up to 8' (SPB1, -L08)



For mounting heights up to 20' (SPB2, -L20)

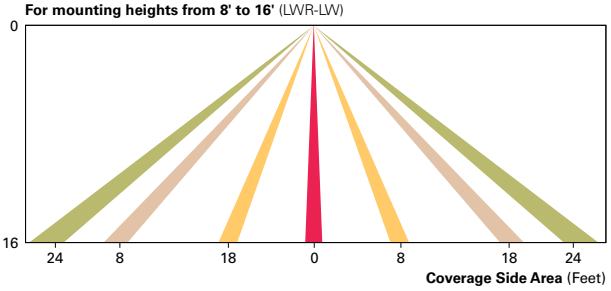


For mounting heights up to 40' (SPB4, -L40W)

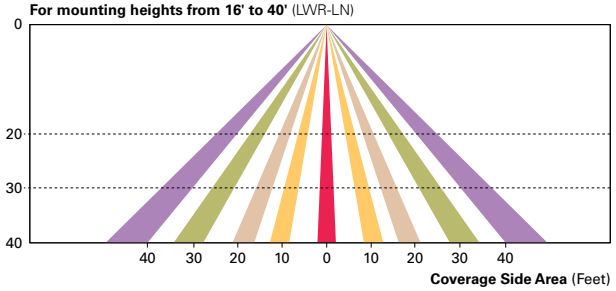


Enlighted Wireless Control and Monitoring System (LWR-LW and LWR-LN)
Enlighted is a connected lighting solution that combines a broad selection of energy-efficient LED luminaires with a powerful integrated wireless sensor system. The sensor controls the lighting system in compliance with the latest energy codes and collects valuable data about building performance and use. Software applications turn the granular data into information through energy dashboards and specialized apps that make it simple and help optimize the use of building resources, beyond lighting.

For mounting heights from 8' to 16' (LWR-LW)

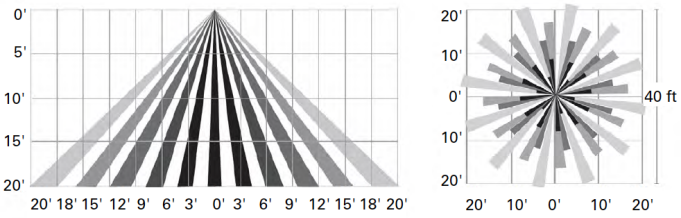


For mounting heights from 16' to 40' (LWR-LN)

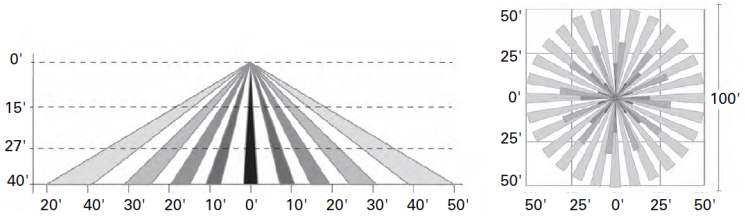


WaveLinx Wireless Control and Monitoring System
Operates on a wireless mesh network based on IEEE 802.15.4 standards enabling wireless control of outdoor lighting. WaveLinx Pro (WPS2 to WPS4) outdoor wireless sensors offer passive infrared (PIR) occupancy and photocell for closed loop daylight harvesting, and can be factory or field-installed. Sensors are factory preset to dim down to 50% after 15 minutes of no motion detected. Two lens options are available for mounting heights of 7′ to 40′. Use the WaveLinx mobile application for set-up and configuration. At least one Wireless Area Controller (WAC) is required for full functionality and remote communication (including adjustment of any factory pre-sets). WaveLinx Lite (WLS4 and WLS2) outdoor wireless sensors provide PIR occupancy and photocell for closed loop daylight harvesting, and can be factory or field-installed. Sensors are factory preset to dim down to 50% after 15 minutes of no motion detected. Two lens options are available for mounting heights of 7′ to 40′. Use the WaveLinx Lite mobile application for set-up and configuration. WAC not required. WaveLinx Outdoor Control Module (WOLC-7P-10A) accessory provides a photocontrol enabling astronomic or time-based schedules to provide ON, OFF and dimming control of fixtures utilizing a 7-PIN receptacle. The out-of-box functionality is ON at dusk and OFF at dawn.

For mounting heights up to 15' (WPS2 and WLS2)



For mounting heights up to 40' (WPS4 and WLS4)



Cooper Lighting Solutions
1121 Highway 74 South
Peachtree City, GA 30269
P: 770-486-4800
www.cooperlighting.com

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Specifications and dimensions subject to change without notice.

Project		Catalog #		Type	
Prepared by		Notes		Date	



McGraw-Edison

GALN Galleon II

Area / Site Luminaire

Product Features

Light ARchitect™

Interactive Menu

- Ordering Information page 2
- Mounting Details page 3
- Optical Distributions page 5
- Product Specifications page 5
- Energy and Performance Data page 6
- Control Options page 11

Product Certifications

Quick Facts

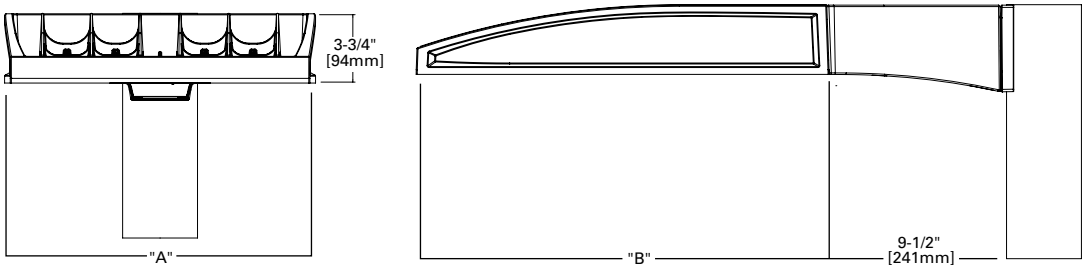
- Lumen packages range from 3,300 - 73,500 (33W - 552W)
- 17 optical distributions
- Efficacy up to 159 lumens per watt

Connected Systems

- Wavelinx LITE Wireless
- Wavelinx PRO Wireless

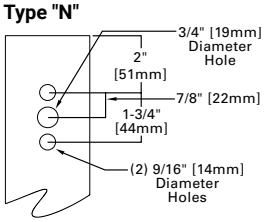
Dimensional Details

Standard Pole Mount Arm



Pole Drilling Pattern

Type "N"



Number of Light Squares	Width "A"	Housing Length "B"	Weight with Standard or QM Arm	EPA with Standard or QM Arm
1-4	16"	22"	29 lb	0.95
5-6	22"	22"	39 lb	0.95
7-9	22"	28-1/8"	48 lb	1.1

NOTES:
For arm selection requirements and additional line art, see Mounting Details section.

NOTES:
1. Visit https://www.designlights.org/search/ to confirm qualification. Not all product variations are DLC qualified.
2. IDA Certified (3000K CCT and warmer only, fixed mounting options)

Ordering Information

SAMPLE NUMBER: **GALN-SA4C-740-U-T4FT-GM**

Product Family [1, 2]	Light Engine		Color Temperature	Voltage	Distribution	Mounting	Finish
	Configuration	Drive Current					
GALN=Galleon II **BAA-GALN**=Galleon II Buy American Act Compliant [26] **TAA-GALN**=Galleon II Trade Agreements Act Compliant [26]	**SA1**=1 Square **SA2**=2 Squares **SA3**=3 Squares **SA4**=4 Squares **SA5**=5 Squares **SA6**=6 Squares **SA7**=7 Squares **SA8**=8 Squares **SA9**=9 Squares	**A**=600mA **B**=800mA **C**=1000mA **D**=1200mA [4, 16] **Z**=Configured [32]	**722**=70CRI, 2200K **727**=70CRI, 2700K **730**=70CRI, 3000K **735**=70CRI, 3500K **740**=70CRI, 4000K **750**=70CRI, 5000K **760**=70CRI, 6000K **827**=80CRI, 2700K **830**=80CRI, 3000K **835**=80CRI, 3500K **840**=80CRI, 4000K **930**=90CRI, 3000K **935**=90CRI, 3500K **940**=90CRI, 4000K **950**=90CRI, 5000K **AMB**=Amber, 590nm [14, 16]	**U**=120-277V **H**=347V-480V [7, 29] **1**=120V **2**=208V **3**=240V **4**=277V **8**=480V [7, 29] **9**=347V [7] **DV**=277V-480V DuraVolt Drivers [28, 29, 30]	**T1**=Type I **T2**=Type II **T2R**=Type II Roadway **T3**=Type III **T3R**=Type III Roadway **T4FT**=Type IV Forward Throw **T4W**=Type IV Wide **5NQ**=Type V Narrow **5MQ**=Type V Square Medium **5WQ**=Type V Square Wide **SL2**=Type II w/Spill Control **SL3**=Type III w/Spill Control **SL4**=Type IV w/Spill Control **SLL**=90° Spill Light Eliminator Left **SLR**=90° Spill Light Eliminator Right **RW**=Rectangular Wide Type I **AFL**=Automotive Frontline	**[Blank]**=Standard Pole Mount Arm **QU**=Quick Mount Universal Arm **QM**=Pole Mount Arm with Quick Mount Adaptor **PA**=Pole Mount, Adjustable **SP**=3" Slipfitter, Adjustable [8] **SP2**=2-3/8" Slipfitter, Adjustable [8] **QMA**=Quick Mount Mast Arm, Fixed **[illegible]**st Arm, Fixed **[illegible]**Wall Mount, Fixed **WA**=Wall Mount, Adjustable **UP**=Upswept Arm	**AP**=Grey **BZ**=Bronze **BK**=Black **DP**=Dark Platinum **GM**=Graphite Metallic **WH**=White **RALXX**=Custom Color

LX2
LX4

Options (Add as Suffix)	Controls and Systems Options (Add as Suffix)	Accessories (Order Separately) [27]
DIM=External 0-10V Dimming Leads [19] **F**=Single Fuse (120, 277 or 347V Specify Voltage) **FF**=Double Fuse (208, 240 or 480V Specify Voltage) **20K**=20kV UL 1449 fused surge protective device [10] **2L**=Two Circuits [10] **HA**=50°C High Ambient **HSS**=Installed House Side Shield [17] **GRSBK**=Glare Reducing Shield, Black [22] **GRSWH**=Glare Reducing Shield, White [22] **LCF**=Light Square Trim Painted to Match Housing [25] **TH**=Tool-less Door Hardware [5] **CC**=Coastal Construction finish [3] **L90**=Optics Rotated 90° Left **R90**=Optics Rotated 90° Right **AHD145**=After Hours Dim, 5 Hours [21] **AHD245**=After Hours Dim, 6 Hours [21] **AHD255**=After Hours Dim, 7 Hours [21] **AHD355**=After Hours Dim, 8 Hours [21] **DALI**=DALI Drivers	**BPC**=Button Type Photocontrol. Must specify voltage 120V, 208V, 240V or 277V. [6] **PR**=NEMA 3-PIN Photocontrol Receptacle **PR7**=NEMA 7-PIN Photocontrol Receptacle [20] **FADC**=Field Adjustable Dimming Controller [31] **PSC**=Photocontrol Shorting Cap **SPB2**=Dimming Motion Sensor, 9'-20' mounting [23] **SPB4**=Dimming Motion Sensor, 21'-40' mounting [23] **SPB2/X**=Dimming Motion Sensor, limited square count, 9'-20' mounting [23] **SPB4/X**=Dimming Motion Sensor, limited square count, 21'-40' mounting [23] **MS/DIM-L20**=Motion Sensor for Dimming Operation, 9'-20' Mounting [33] **MS/DIM-L40**=Motion Sensor for Dimming Operation, 21'-40' Mounting [33] **WLS2XX**=WaveLinx LITE, SR Driver, Dimming Motion and Daylight, Bluetooth Programmable, 7' - 15' Mounting [18, 12, 34] **WLS4XX**=WaveLinx LITE, SR Driver, Dimming Motion and Daylight, Bluetooth Programmable, 15' - 40' Mounting [18, 12, 34] **WPS2XX**=WaveLinx PRO, SR Driver, Dimming Motion and Daylight, WAC Programmable, 7' - 15' Mounting [18, 12, 13, 34] **WPS4XX**=WaveLinx PRO, SR Driver, Dimming Motion and Daylight, WAC Programmable, 15' - 40' Mounting [18, 12, 13, 34] **DIM10-L20**=AirMesh Occupancy Sensor (9'-20' Mounting) [18] **DIM10-L40**=AirMesh Occupancy Sensor (21'-40' Mounting) [18]	**OA/RA1016**=NEMA Photocontrol Multi-Tap - 105-285V **OA/RA1027**=NEMA Photocontrol - 480V **OA/RA1201**=NEMA Photocontrol - 347V **OA/RA1013**=Photocontrol Shorting Cap **OA/RA1014**=120V Photocontrol **MA1252**=10kV Surge Module Replacement **MA1036-XX**=Single Tenon Adapter for 2-3/8" O.D. Tenon **MA1037-XX**=2@180° Tenon Adapter for 2-3/8" O.D. Tenon **MA1197-XX**=3@120° Tenon Adapter for 2-3/8" O.D. Tenon **MA1188-XX**=4@90° Tenon Adapter for 2-3/8" O.D. Tenon **MA1189-XX**=2@90° Tenon Adapter for 2-3/8" O.D. Tenon **MA1190-XX**=3@90° Tenon Adapter for 2-3/8" O.D. Tenon **MA1191-XX**=2@120° Tenon Adapter for 2-3/8" O.D. Tenon **MA1038-XX**=Single Tenon Adapter for 3-1/2" O.D. Tenon **MA1039-XX**=2@180° Tenon Adapter for 3-1/2" O.D. Tenon **MA1192-XX**=3@120° Tenon Adapter for 3-1/2" O.D. Tenon **MA1193-XX**=4@90° Tenon Adapter for 3-1/2" O.D. Tenon **MA1194-XX**=2@90° Tenon Adapter for 3-1/2" O.D. Tenon **MA1195-XX**=3@90° Tenon Adapter for 3-1/2" O.D. Tenon **SRA238**=Adapter kit for mounting 3" SP arm to 2-3/8" O.D. vertical tenon **FSIR-100**=Wireless Configuration Tool for MS/DIM [33] **LS/HSS**=Field Installed House Side Shield [9, 17] **LS/GRSBK-2PK** =Glare Reducing Shield, Black [9, 22] **LS/GRSWH-2PK** =Glare Reducing Shield, White [9, 22] **LS/PFS**=Perimeter Shield, Black [15] **WOLC-7P-10A**=WaveLinx Outdoor Control Module [11, 18] **TL7-HVG**= AirMesh 7-PIN node, 110-480V [11, 18]

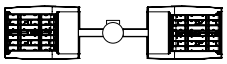
NOTES:

1. Customer is responsible for engineering analysis to confirm pole and fixture compatibility for all applications. Refer to our white paper WP513001EN for additional support information.
2. DesignLights Consortium® Qualified. Refer to www.designlights.org Qualified Products List under Family Models for details.
3. Coastal construction finish salt spray tested to over 5,000-hours per ASTM B117, with a scribe rating of 9 per ASTM D1654. Not available with TH option.
4. Drive current 1200mA not available with color temperatures 722, 727, 827, 830 or 930 when the HSS option is selected
5. TH option not 3G rated. Not available with Coastal Construction (CC) option.
6. Not available with voltage options H, 8 or 9.
7. Requires the use of an internal step down transformer when combined with sensor options. Not available in combination with the HA high ambient and sensor options at 1A.
8. SP arm limited to 3" O.D. vertical tenon. SP2 limited to 2-3/8" O.D. vertical tenon.
9. One required for each Light Square.
10. 2L is not available with SPB at 347V or 480V. Not available with WaveLinx or Enlighted sensors, or 20kV surge option
11. Requires PR7.
12. Replace XX with sensor color (WH, BZ or BK.)
13. WAC Gateway required to enable field-configurability: Order WAC-PoE and WPOE-120 (10V to PoE injector) power supply if needed. WAC not required for LC Bluetooth sensors.
14. Narrow-band 590nm +/- 5nm for wildlife and observatory use. Choose drive current A; supplied at 500mA drive current only. Exact luminaire wattage available in IES files. Available with 5WQ, 5MQ, SL2, SL3 and SL4 distributions. Can be used with HSS option.
15. Set of 4 pcs. One set required per Light Square.
16. Not available with HA option.
17. Not for use with T1, 5NQ, 5MQ, 5WQ or RW optics.
18. Cannot be used with other control options.
19. Low voltage control lead brought out 18" outside fixture. Not available with DALI or integrated controls options
20. Not available if any SPB, LWR, or WaveLinx sensor is selected. Motion sensor has an integral photocell.
21. Requires the use of BPC photocontrol or the PR7 or PR photocontrol receptacle with photocontrol accessory.
22. Not for use with T1, T4FT, T4W or SL4 optics.
23. Sensor configuration mobile application required for configuration. See controls page for details.
24. Replace X with number of Light Squares controlled by the SPB, referencing the "SPB/X Availability Table" on the controls page.
25. Not available with HSS, GRSWH or GRSBK.
26. Only product configurations with these designated prefixes are built to be compliant with the Buy American Act of 1933 (BAA) or Trade Agreements Act of 1979 (TAA), respectively. Please refer to DOMESTIC PREFERENCES website for more information.Components shipped separately may be separately analyzed under domestic preference requirements.
27. For BAA or TAA requirements, Accessories sold separately will be separately analyzed under domestic preference requirements. Consult factory for further information.
28. DuraVolt drivers feature added protection from power quality issues such as loss of neutral, transients and voltage fluctuations. Visit www.signify.com/duravolt for more information.
29. 480V not to be used with ungrounded or impedance grounded systems.
30. Not available in 1 square configuration at 800mA or below. Not available with any control option except SPB.
31. Cannot be used with PR7 or other motion response control options.
32. Use GALN Product Configurator to specify lumen output, drive current and wattage. Not available with AMB.
33. Uses the FSP-211 motion sensor. The FSIR-100 configuration tool is required to adjust parameters including high and low modes, sensitivity, time delay, cutoff and more. Consult your lighting representative at Cooper Lighting Solutions for more information.
34. Controls system is not available with photocontrol receptacles (PR , PR7) or other controls systems (FADC, SPBx).

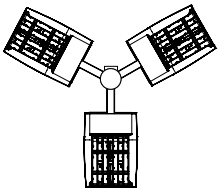
Mounting Details

Pole Configuration Options

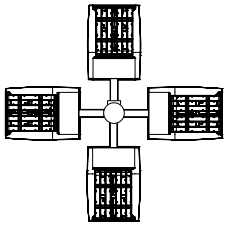
2 @ 180°



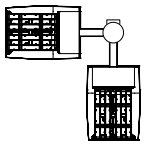
3 @ 120°
(Round poles only)



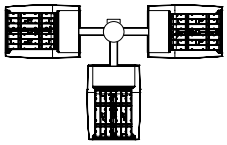
4 @ 90°



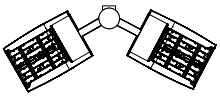
2 @ 90°



3 @ 90°

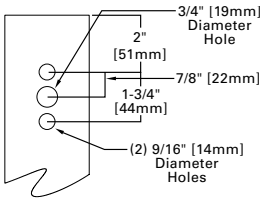


2 @ 120°
(Round poles only)

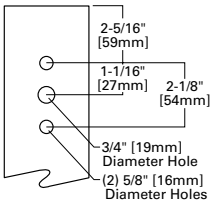


Pole Drilling Patterns

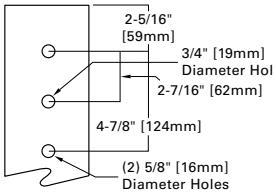
Type "N"



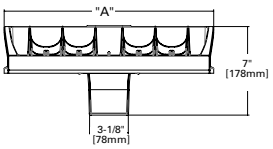
Type "R"

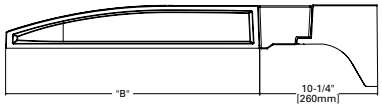


Type "M"



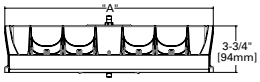
Quick Mount Universal Arm (QU)



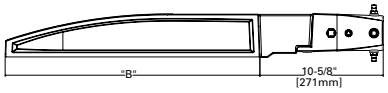


*NOTE: Universal bolt pattern compatible with Type N through Type M drilling patterns

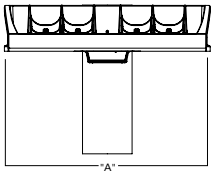
Quick Mount Mast Arm (QMA)

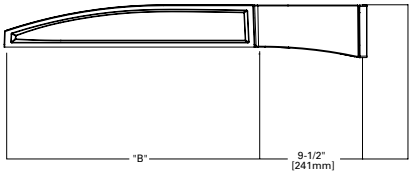


*NOTE: Fits 2-3/8" O.D. tenon



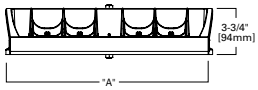
Pole Mount Arm with Quick Mount Adaptor (QM)



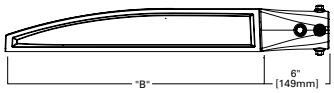


*NOTE: Use Type N drilling pattern

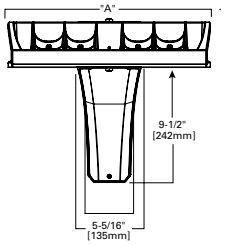
Mast Arm, Fixed (MA)

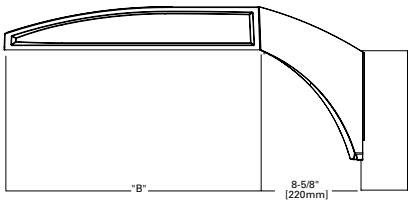


*NOTE: Fits 2-3/8" O.D. tenon



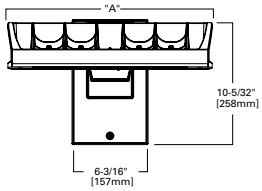
Upswept Arm (UP)

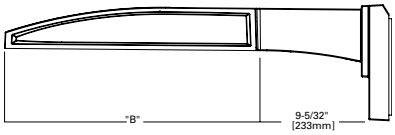




*NOTE: Universal bolt pattern compatible with Type N through Type M drilling patterns

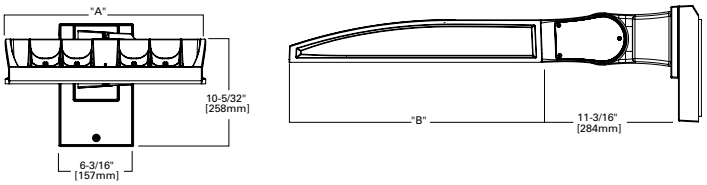
Wall Mount, Fixed (WM)



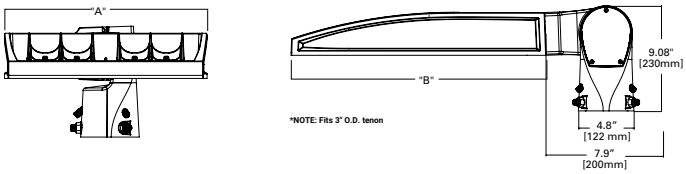


Mounting Details

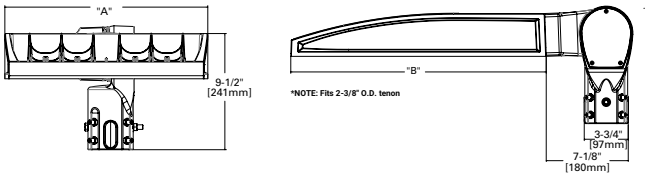
Wall Mount, Adjustable (WA)



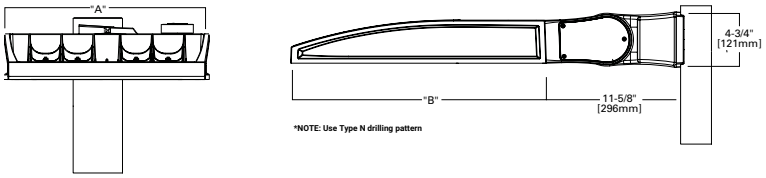
3" Slipfitter, Adjustable (SP)



2-3/8" Slipfitter, Adjustable (SP2)

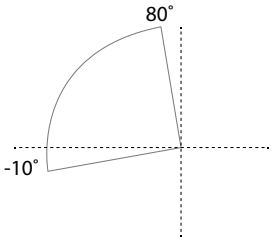


Pole Mount, Adjustable Arm (PA)



Adjustable Arm Range of Motion

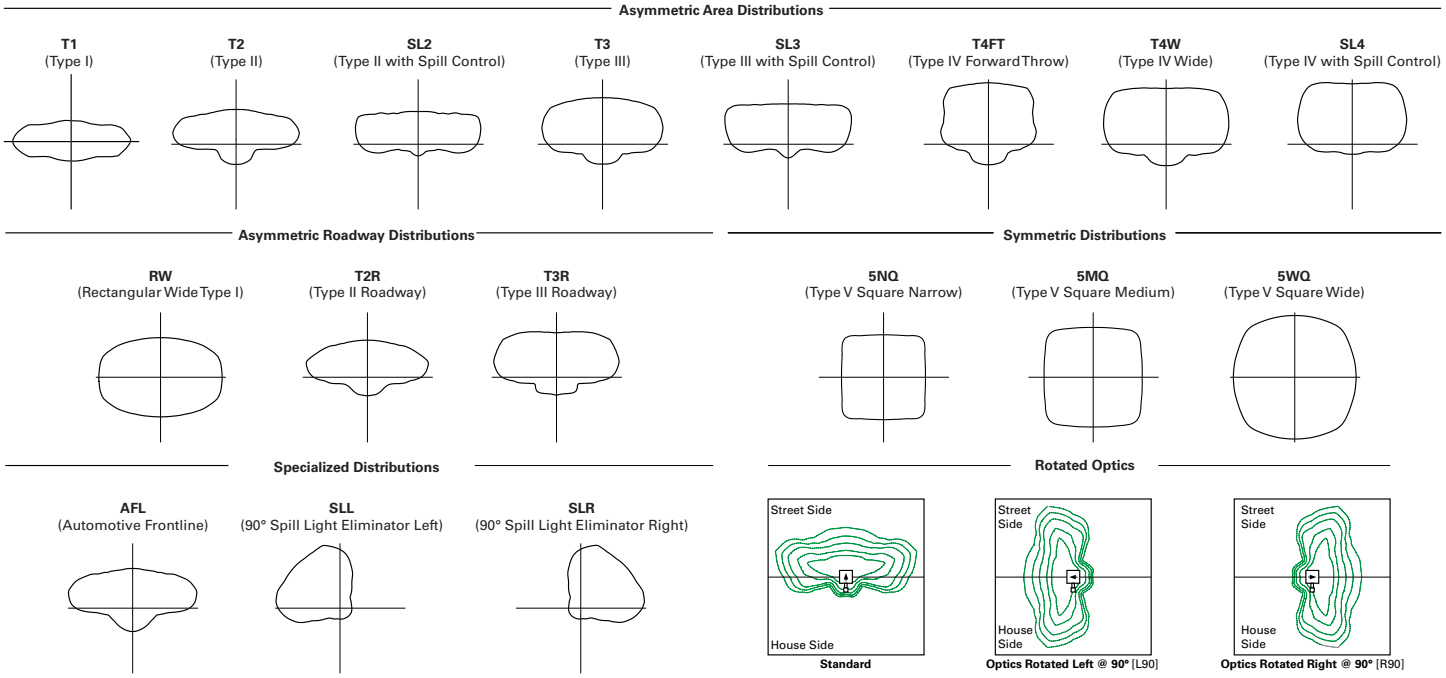
- Includes WA, SP, SP2 and PA mounting options
- Adjustable in increments of 5°
- Must maintain downward facing orientation



Fixture Weights and EPAs

Tilt Angle (Degrees)	Number of Light Squares	Weight	1 @ 90°	2 @ 180°	2 @ 90°	2 @ 120°	3 @ 90°	3 @ 120°	4 @ 90°
0°	1-4	33.5 lb (15.2 kg)	0.85	1.70	1.46	1.66	2.31	2.25	2.35
	5-6	43.5 lb (19.7 kg)	0.86	1.71	1.62	1.80	2.49	2.35	2.50
	7-9	52.5 lb (23.8 kg)	0.98	1.95	1.75	1.98	2.73	2.55	2.76
15°	1-4	33.5 lb (15.2 kg)	1.10	1.71	1.95	2.26	2.81	3.30	2.87
	5-6	43.5 lb (19.7 kg)	1.42	1.71	2.27	2.72	3.13	3.63	3.15
	7-9	52.5 lb (23.8 kg)	1.69	1.96	2.67	3.22	3.65	4.38	3.72
30°	1-4	33.5 lb (15.2 kg)	1.72	1.81	2.58	3.21	3.44	4.59	3.53
	5-6	43.5 lb (19.7 kg)	2.26	2.29	3.11	4.00	3.97	5.27	4.00
	7-9	52.5 lb (23.8 kg)	2.75	2.85	3.73	4.83	4.71	6.45	4.81
45°	1-4	33.5 lb (15.2 kg)	2.25	2.36	3.10	4.00	3.96	5.63	4.08
	5-6	43.5 lb (19.7 kg)	2.96	2.99	3.81	5.06	4.67	6.49	4.71
	7-9	52.5 lb (23.8 kg)	3.63	3.76	3.73	6.17	5.59	8.03	5.73
60°	1-4	33.5 lb (15.2 kg)	2.63	2.77	3.49	4.58	4.34	6.21	4.48
	5-6	43.5 lb (19.7 kg)	3.46	3.51	4.32	5.84	5.19	7.01	5.22
	7-9	52.5 lb (23.8 kg)	4.27	4.44	5.25	7.15	6.23	8.80	6.40

Optical Distributions



Product Specifications

Construction
- Die-cast aluminum housing and heat sink
- Three housing sizes, using 1 to 9 light squares

Optics
- High-efficiency injection-molded AccuLED Optics technology
- 17 optical distributions for area site and roadway applications
- 3 shielding options include HSS, GRS and PFS
- IDA Certified (3000K CCT and warmer only, fixed mounting options)

Electrical
- Removable power tray assembly includes drivers, surge modules and control modules for ease of maintenance and serviceability
- Standard with 0-10V dimming
- Standard with 10kV surge module, optional 20kV surge module
- Suitable for operation in -40°C to 40°C ambient environments. Optional 50°C high ambient (HA) configuration
- Luminaire available with the field adjustable dimming controller (FADC) to manually adjust wattage and reduce the total lumen output and light levels. Comes pre-set to the highest position at the lumen output selected

Mounting
- Arms are factory installed, enabling closed-housing installation
- All arms suitable for round or square pole installation
- All arms provide clearance for multiple fixture installations at 90°

Finish
- 6 standard finishes use super durable TGIC polyester powder coat paint, providing 2.5 mil nominal thickness and salt-spray tested to 3,000 hours per ASTM B117
- RAL and custom color matches available
- Coastal Construction (CC) option salt-spray tested to 5,000 hours per ASTM B117, achieving a scribe rating of 9 per ASTM D1654

Typical Applications
- Outdoor, Parking Lots, Walkways, Roadways, Building Areas

Warranty
- Five-year limited warranty. Consult website for details. www.cooperlighting.com/legal

Energy and Performance Data

Lumen Maintenance (TM-21)

Drive Current	Ambient Temperature	25,000 hours*	50,000 hours*	60,000 hours*	100,000 hours**	Theoretical L70 hours**
Up to 1A	25°C	99.4%	99.0%	98.9%	98.3%	> 2.4M
	40°C	98.7%	98.3%	98.1%	97.4%	> 1.9M
	50°C	98.2%	97.2%	96.8%	95.2%	> 851,000
1.2A	25°C	99.4%	99.0%	98.9%	98.3%	> 2.4M
	40°C	98.5%	97.9%	97.7%	96.7%	> 1.3M

* Supported by IES TM-21 standards
** Theoretical values represent estimations commonly used; however, refer to the IES position on LED Product Lifetime Prediction, IES PS-10-18, explaining proper use of IES TM-21 and LM-80.

Lumen Multiplier

Ambient Temperature	Lumen Multiplier
0ºC	1.02
10ºC	1.01
25ºC	1.00
40ºC	0.99
50ºC	0.97

FADC Settings
SA1-SA3 (A, B, C, D Drive Current)

FADC Position	Percent of Typical Lumen Output
1	25%
2	48%
3	56%
4	65%
5	75%
6	80%
7	85%
8	90%
9	95%
10	100%

Note: +/-5% typical value

FADC Settings
SA4-SA6 (A, B, C, D Drive Current)

FADC Position	Percent of Typical Lumen Output
1	14%
2	25%
3	32%
4	43%
5	49%
6	57%
7	65%
8	72%
9	80%
10	100%

Note: +/-5% typical value

FADC Settings
SA7-SA9 (A, B, C, D Drive Current)

FADC Position	Percent of Typical Lumen Output
1	19%
2	38%
3	47%
4	63%
5	74%
6	85%
7	95%
8	97%
9	100%
10	100%

Note: +/-5% typical value

McGraw-Edison

GALN Galleon II

Performance Table, Drive Current "A" (615mA)

Galleon II IES Files | Supplemental Lumen Tables

Number of Light Squares		1	2	3	4	5	6	7	8	9
Nominal Power (Watts)		33	63	93	121	154	182	215	244	274
Input Current @ 120V		0.283	0.529	0.778	1.058	1.310	1.556	1.839	2.089	2.335
Input Current @ 208V		0.165	0.309	0.460	0.618	0.771	0.919	1.082	1.240	1.379
Input Current @ 240V		0.143	0.270	0.398	0.540	0.671	0.796	0.944	1.078	1.194
Input Current @ 277V		0.125	0.237	0.352	0.473	0.581	0.705	0.818	0.962	1.057
Input Current @ 347V		0.098	0.181	0.272	0.362	0.454	0.544	0.636	0.738	0.816
Input Current @ 480V		0.073	0.133	0.200	0.267	0.335	0.400	0.470	0.554	0.600
Optics										
T1	4000K Lumens	4,619	9,180	13,628	18,059	22,861	27,070	31,796	36,863	41,385
	BUG Rating	B2-U0-G1	B3-U0-G1	B3-U0-G2	B4-U0-G2	B4-U0-G2	B4-U0-G2	B5-U0-G3	B5-U0-G3	B5-U0-G3
	Lumens per Watt	140	146	147	149	148	149	148	151	151
T2	4000K Lumens	4,654	9,249	13,730	18,194	23,032	27,273	32,034	37,138	41,694
	BUG Rating	B1-U0-G1	B1-U0-G2	B2-U0-G2	B2-U0-G3	B3-U0-G4	B3-U0-G4	B3-U0-G4	B3-U0-G5	B3-U0-G5
	Lumens per Watt	141	147	148	150	150	150	149	152	152
T2R	4000K Lumens	4,716	9,372	13,913	18,437	23,340	27,637	32,462	37,634	42,251
	BUG Rating	B1-U0-G1	B1-U0-G2	B2-U0-G2	B2-U0-G2	B3-U0-G3	B3-U0-G3	B3-U0-G4	B3-U0-G4	B3-U0-G4
	Lumens per Watt	143	149	150	152	152	152	151	154	154
T3	4000K Lumens	4,589	9,120	13,538	17,940	22,711	26,892	31,587	36,620	41,112
	BUG Rating	B1-U0-G1	B2-U0-G2	B2-U0-G2	B3-U0-G3	B3-U0-G3	B3-U0-G4	B3-U0-G4	B3-U0-G4	B4-U0-G4
	Lumens per Watt	139	145	146	148	147	148	147	150	150
T3R	4000K Lumens	4,735	9,411	13,970	18,513	23,436	27,751	32,596	37,790	42,425
	BUG Rating	B1-U0-G1	B1-U0-G2	B2-U0-G3	B2-U0-G3	B3-U0-G4	B3-U0-G4	B3-U0-G4	B3-U0-G5	B3-U0-G5
	Lumens per Watt	143	149	150	153	152	152	152	155	155
T4FT	4000K Lumens	4,617	9,176	13,622	18,051	22,851	27,058	31,782	36,847	41,366
	BUG Rating	B1-U0-G2	B2-U0-G2	B2-U0-G3	B3-U0-G3	B3-U0-G4	B3-U0-G4	B3-U0-G5	B3-U0-G5	B3-U0-G5
	Lumens per Watt	140	146	146	149	148	149	148	151	151
T4W	4000K Lumens	4,631	9,203	13,662	18,104	22,918	27,138	31,876	36,955	41,488
	BUG Rating	B1-U0-G2	B2-U0-G2	B2-U0-G3	B3-U0-G3	B3-U0-G4	B3-U0-G4	B3-U0-G5	B3-U0-G5	B4-U0-G5
	Lumens per Watt	140	146	147	150	149	149	148	151	151
SL2	4000K Lumens	4,619	9,180	13,627	18,058	22,860	27,069	31,795	36,861	41,383
	BUG Rating	B1-U0-G2	B2-U0-G2	B2-U0-G3	B3-U0-G3	B3-U0-G4	B3-U0-G4	B3-U0-G4	B3-U0-G5	B4-U0-G5
	Lumens per Watt	140	146	147	149	148	149	148	151	151
SL3	4000K Lumens	4,586	9,115	13,531	17,931	22,699	26,879	31,571	36,602	41,091
	BUG Rating	B1-U0-G1	B1-U0-G2	B2-U0-G3	B2-U0-G3	B3-U0-G4	B3-U0-G4	B3-U0-G4	B3-U0-G5	B3-U0-G5
	Lumens per Watt	139	145	145	148	147	148	147	150	150
SL4	4000K Lumens	4,529	9,002	13,363	17,708	22,417	26,544	31,178	36,146	40,580
	BUG Rating	B1-U0-G2	B1-U0-G3	B2-U0-G3	B2-U0-G4	B2-U0-G4	B3-U0-G5	B3-U0-G5	B3-U0-G5	B3-U0-G5
	Lumens per Watt	137	143	144	146	146	146	145	148	148
5NQ	4000K Lumens	4,829	9,598	14,247	18,880	23,901	28,301	33,242	38,539	43,266
	BUG Rating	B2-U0-G1	B3-U0-G1	B3-U0-G2	B4-U0-G2	B4-U0-G2	B4-U0-G2	B5-U0-G2	B5-U0-G3	B5-U0-G3
	Lumens per Watt	146	152	153	156	155	155	155	158	158
5MQ	4000K Lumens	4,853	9,645	14,318	18,974	24,020	28,442	33,407	38,731	43,482
	BUG Rating	B3-U0-G1	B3-U0-G2	B4-U0-G2	B4-U0-G2	B5-U0-G3	B5-U0-G3	B5-U0-G4	B5-U0-G4	B5-U0-G4
	Lumens per Watt	147	153	154	157	156	156	155	159	159
5WQ	4000K Lumens	4,843	9,625	14,288	18,934	23,969	28,382	33,337	38,649	43,390
	BUG Rating	B3-U0-G1	B4-U0-G2	B4-U0-G2	B5-U0-G3	B5-U0-G3	B5-U0-G4	B5-U0-G4	B5-U0-G4	B5-U0-G5
	Lumens per Watt	147	153	154	156	156	156	155	158	158
SLL/ SLR	4000K Lumens	3,989	7,927	11,768	15,594	19,741	23,375	27,456	31,831	35,736
	BUG Rating	B1-U0-G2	B1-U0-G2	B2-U0-G3	B2-U0-G3	B2-U0-G4	B3-U0-G4	B3-U0-G4	B3-U0-G5	B3-U0-G5
	Lumens per Watt	121	126	127	129	128	128	128	130	130
RW	4000K Lumens	4,774	9,488	14,085	18,665	23,628	27,979	32,863	38,100	42,774
	BUG Rating	B2-U0-G1	B3-U0-G1	B3-U0-G2	B4-U0-G2	B4-U0-G2	B4-U0-G2	B5-U0-G3	B5-U0-G3	B5-U0-G3
	Lumens per Watt	145	151	151	154	153	154	153	156	156
AFL	4000K Lumens	4,673	9,286	13,785	18,268	23,126	27,384	32,164	37,290	41,864
	BUG Rating	B1-U0-G1	B1-U0-G1	B2-U0-G2	B2-U0-G2	B3-U0-G2	B3-U0-G2	B3-U0-G3	B3-U0-G3	B3-U0-G3
	Lumens per Watt	142	147	148	151	150	150	150	153	153

* Nominal data for 70 CRI. ** For additional performance data, please reference the Galleon Supplemental Performance Guide.

McGraw-Edison GALN Galleon II

Performance Table, Drive Current "B" (800mA)

Galleon II IES Files | Supplemental Lumen Tables

Number of Light Squares		1	2	3	4	5	6	7	8	9
Nominal Power (Watts)		44	82	121	164	204	243	286	325	364
Input Current @ 120V		0.367	0.689	1.014	1.378	1.704	2.027	2.393	2.716	3.041
Input Current @ 208V		0.213	0.401	0.594	0.802	0.997	1.188	1.400	1.605	1.782
Input Current @ 240V		0.184	0.347	0.510	0.694	0.860	1.021	1.210	1.386	1.531
Input Current @ 277V		0.160	0.303	0.449	0.605	0.757	0.898	1.065	1.242	1.347
Input Current @ 347V		0.125	0.235	0.355	0.471	0.592	0.710	0.828	0.958	1.065
Input Current @ 480V		0.092	0.172	0.258	0.344	0.432	0.517	0.605	0.706	0.775
Optics										
T1	4000K Lumens	5,748	11,423	16,957	22,470	28,446	33,683	39,563	45,867	51,494
	BUG Rating	B2-U0-G1	B3-U0-G2	B4-U0-G2	B4-U0-G2	B4-U0-G2	B5-U0-G3	B5-U0-G3	B5-U0-G4	B5-U0-G4
	Lumens per Watt	131	139	140	137	139	139	138	141	141
T2	4000K Lumens	5,790	11,508	17,083	22,638	28,658	33,935	39,859	46,210	51,879
	BUG Rating	B1-U0-G2	B2-U0-G2	B2-U0-G3	B3-U0-G4	B3-U0-G4	B3-U0-G4	B3-U0-G5	B3-U0-G5	B4-U0-G5
	Lumens per Watt	132	140	141	138	140	140	139	142	143
T2R	4000K Lumens	5,868	11,662	17,311	22,941	29,041	34,388	40,391	46,827	52,572
	BUG Rating	B1-U0-G1	B2-U0-G2	B2-U0-G2	B3-U0-G3	B3-U0-G3	B3-U0-G4	B3-U0-G4	B3-U0-G4	B3-U0-G5
	Lumens per Watt	133	142	143	140	142	142	141	144	144
T3	4000K Lumens	5,710	11,347	16,845	22,322	28,258	33,461	39,303	45,565	51,155
	BUG Rating	B1-U0-G1	B2-U0-G2	B3-U0-G3	B3-U0-G3	B3-U0-G4	B3-U0-G4	B4-U0-G4	B4-U0-G5	B4-U0-G5
	Lumens per Watt	130	138	139	136	139	138	137	140	141
T3R	4000K Lumens	5,892	11,710	17,383	23,035	29,161	34,530	40,558	47,020	52,788
	BUG Rating	B1-U0-G2	B2-U0-G2	B2-U0-G3	B3-U0-G4	B3-U0-G4	B3-U0-G5	B3-U0-G5	B3-U0-G5	B4-U0-G5
	Lumens per Watt	134	143	144	140	143	142	142	145	145
T4FT	4000K Lumens	5,745	11,418	16,949	22,460	28,433	33,668	39,546	45,847	51,471
	BUG Rating	B1-U0-G2	B2-U0-G3	B2-U0-G3	B3-U0-G4	B3-U0-G4	B3-U0-G5	B3-U0-G5	B4-U0-G5	B4-U0-G5
	Lumens per Watt	131	139	140	137	139	139	138	141	141
T4W	4000K Lumens	5,762	11,451	16,999	22,526	28,517	33,767	39,662	45,982	51,622
	BUG Rating	B1-U0-G2	B2-U0-G2	B3-U0-G3	B3-U0-G4	B3-U0-G4	B3-U0-G5	B4-U0-G5	B4-U0-G5	B4-U0-G5
	Lumens per Watt	131	140	140	137	140	139	139	141	142
SL2	4000K Lumens	5,747	11,422	16,956	22,469	28,444	33,681	39,561	45,865	51,491
	BUG Rating	B1-U0-G2	B2-U0-G3	B3-U0-G3	B3-U0-G4	B3-U0-G4	B3-U0-G4	B4-U0-G5	B4-U0-G5	B4-U0-G5
	Lumens per Watt	131	139	140	137	139	139	138	141	141
SL3	4000K Lumens	5,707	11,342	16,836	22,311	28,244	33,444	39,283	45,542	51,129
	BUG Rating	B1-U0-G2	B2-U0-G3	B2-U0-G3	B3-U0-G4	B3-U0-G4	B3-U0-G5	B3-U0-G5	B3-U0-G5	B3-U0-G5
	Lumens per Watt	130	138	139	136	138	138	137	140	140
SL4	4000K Lumens	5,636	11,201	16,627	22,034	27,893	33,028	38,794	44,976	50,493
	BUG Rating	B1-U0-G2	B1-U0-G3	B2-U0-G4	B2-U0-G4	B3-U0-G5	B3-U0-G5	B3-U0-G5	B3-U0-G5	B3-U0-G5
	Lumens per Watt	128	137	137	134	137	136	136	138	139
5NQ	4000K Lumens	6,009	11,942	17,727	23,492	29,739	35,214	41,362	47,953	53,835
	BUG Rating	B2-U0-G1	B3-U0-G1	B4-U0-G2	B4-U0-G2	B5-U0-G2	B5-U0-G2	B5-U0-G3	B5-U0-G3	B5-U0-G3
	Lumens per Watt	137	146	147	143	146	145	145	148	148
5MQ	4000K Lumens	6,039	12,001	17,816	23,609	29,887	35,389	41,568	48,191	54,103
	BUG Rating	B3-U0-G1	B4-U0-G2	B4-U0-G2	B5-U0-G3	B5-U0-G3	B5-U0-G4	B5-U0-G4	B5-U0-G4	B5-U0-G5
	Lumens per Watt	137	146	147	144	147	146	145	148	149
5WQ	4000K Lumens	6,026	11,976	17,778	23,559	29,824	35,315	41,480	48,090	53,989
	BUG Rating	B3-U0-G1	B4-U0-G2	B5-U0-G3	B5-U0-G3	B5-U0-G4	B5-U0-G4	B5-U0-G4	B5-U0-G5	B5-U0-G5
	Lumens per Watt	137	146	147	144	146	145	145	148	148
SLL/ SLR	4000K Lumens	4,963	9,863	14,642	19,403	24,563	29,085	34,163	39,607	44,465
	BUG Rating	B1-U0-G2	B1-U0-G3	B2-U0-G3	B2-U0-G4	B3-U0-G4	B3-U0-G5	B3-U0-G5	B3-U0-G5	B3-U0-G5
	Lumens per Watt	113	120	121	118	120	120	119	122	122
RW	4000K Lumens	5,940	11,806	17,526	23,224	29,400	34,813	40,891	47,407	53,222
	BUG Rating	B3-U0-G1	B3-U0-G2	B4-U0-G2	B4-U0-G2	B5-U0-G3	B5-U0-G3	B5-U0-G3	B5-U0-G4	B5-U0-G4
	Lumens per Watt	135	144	145	142	144	143	143	146	146
AFL	4000K Lumens	5,814	11,555	17,153	22,730	28,775	34,073	40,021	46,398	52,090
	BUG Rating	B1-U0-G1	B2-U0-G1	B2-U0-G2	B2-U0-G2	B3-U0-G3	B3-U0-G3	B3-U0-G3	B3-U0-G3	B3-U0-G4
	Lumens per Watt	132	141	142	139	141	140	140	143	143

* Nominal data for 70 CRI. ** For additional performance data, please reference the Galleon Supplemental Performance Guide.

McGraw-Edison GALN Galleon II

Performance Table, Drive Current "C" (1050mA)

Galleon II IES Files | Supplemental Lumen Tables

Number of Light Squares		1	2	3	4	5	6	7	8	9
Nominal Power (Watts)		57	108	160	213	269	321	377	429	481
Input Current @ 120V		0.478	0.905	1.338	1.810	2.244	2.675	3.150	3.584	4.013
Input Current @ 208V		0.279	0.532	0.780	1.064	1.313	1.559	1.845	2.093	2.339
Input Current @ 240V		0.243	0.458	0.664	0.916	1.123	1.328	1.582	1.788	1.991
Input Current @ 277V		0.213	0.404	0.582	0.808	0.997	1.164	1.401	1.589	1.745
Input Current @ 347V		0.164	0.322	0.471	0.644	0.795	0.943	1.117	1.269	1.414
Input Current @ 480V		0.121	0.235	0.341	0.469	0.579	0.681	0.814	0.923	1.022
Optics										
T1	4000K Lumens	7,101	14,113	20,950	27,763	35,146	41,616	48,882	56,671	63,623
	BUG Rating	B3-U0-G1	B3-U0-G2	B4-U0-G2	B4-U0-G2	B5-U0-G3	B5-U0-G3	B5-U0-G4	B5-U0-G4	B5-U0-G4
	Lumens per Watt	125	131	131	130	131	130	130	132	132
T2	4000K Lumens	7,154	14,219	21,107	27,970	35,408	41,927	49,247	57,094	64,098
	BUG Rating	B1-U0-G2	B2-U0-G2	B3-U0-G3	B3-U0-G4	B3-U0-G4	B3-U0-G5	B4-U0-G5	B4-U0-G5	B4-U0-G5
	Lumens per Watt	126	132	132	131	132	131	131	133	133
T2R	4000K Lumens	7,250	14,408	21,389	28,344	35,881	42,487	49,905	57,857	64,954
	BUG Rating	B1-U0-G1	B2-U0-G2	B2-U0-G3	B3-U0-G3	B3-U0-G4	B3-U0-G4	B3-U0-G5	B4-U0-G5	B4-U0-G5
	Lumens per Watt	127	133	134	133	133	132	132	135	135
T3	4000K Lumens	7,054	14,020	20,812	27,580	34,914	41,342	48,560	56,297	63,203
	BUG Rating	B1-U0-G2	B2-U0-G2	B3-U0-G3	B3-U0-G4	B3-U0-G4	B4-U0-G4	B4-U0-G5	B4-U0-G5	B4-U0-G5
	Lumens per Watt	124	130	130	129	130	129	129	131	131
T3R	4000K Lumens	7,280	14,468	21,477	28,461	36,029	42,663	50,111	58,096	65,222
	BUG Rating	B1-U0-G2	B2-U0-G3	B3-U0-G4	B3-U0-G4	B3-U0-G5	B3-U0-G5	B3-U0-G5	B4-U0-G5	B4-U0-G5
	Lumens per Watt	128	134	134	134	134	133	133	135	136
T4FT	4000K Lumens	7,098	14,107	20,941	27,751	35,130	41,598	48,860	56,646	63,594
	BUG Rating	B1-U0-G2	B2-U0-G3	B3-U0-G4	B3-U0-G4	B3-U0-G5	B3-U0-G5	B4-U0-G5	B4-U0-G5	B4-U0-G5
	Lumens per Watt	125	131	131	130	131	130	130	132	132
T4W	4000K Lumens	7,119	14,148	21,003	27,832	35,233	41,720	49,004	56,812	63,781
	BUG Rating	B1-U0-G2	B2-U0-G3	B3-U0-G4	B3-U0-G4	B3-U0-G5	B4-U0-G5	B4-U0-G5	B4-U0-G5	B4-U0-G5
	Lumens per Watt	125	131	131	131	131	130	130	132	133
SL2	4000K Lumens	7,101	14,112	20,949	27,761	35,144	41,614	48,879	56,668	63,619
	BUG Rating	B1-U0-G2	B2-U0-G3	B3-U0-G3	B3-U0-G4	B3-U0-G5	B4-U0-G5	B4-U0-G5	B4-U0-G5	B4-U0-G5
	Lumens per Watt	125	131	131	130	131	130	130	132	132
SL3	4000K Lumens	7,051	14,013	20,802	27,566	34,897	41,321	48,535	56,269	63,172
	BUG Rating	B1-U0-G2	B2-U0-G3	B2-U0-G4	B3-U0-G4	B3-U0-G5	B3-U0-G5	B3-U0-G5	B4-U0-G5	B4-U0-G5
	Lumens per Watt	124	130	130	129	130	129	129	131	131
SL4	4000K Lumens	6,963	13,839	20,543	27,223	34,463	40,808	47,932	55,569	62,386
	BUG Rating	B1-U0-G2	B2-U0-G3	B2-U0-G4	B3-U0-G5	B3-U0-G5	B3-U0-G5	B3-U0-G5	B3-U0-G5	B3-U0-G5
	Lumens per Watt	122	128	128	128	128	127	127	130	130
5NQ	4000K Lumens	7,424	14,755	21,903	29,025	36,743	43,508	51,104	59,247	66,515
	BUG Rating	B3-U0-G1	B3-U0-G2	B4-U0-G2	B5-U0-G2	B5-U0-G3	B5-U0-G3	B5-U0-G3	B5-U0-G4	B5-U0-G4
	Lumens per Watt	130	137	137	136	137	136	136	138	138
5MQ	4000K Lumens	7,461	14,828	22,012	29,169	36,926	43,725	51,359	59,542	66,846
	BUG Rating	B3-U0-G1	B4-U0-G2	B5-U0-G3	B5-U0-G3	B5-U0-G4	B5-U0-G4	B5-U0-G4	B5-U0-G5	B5-U0-G5
	Lumens per Watt	131	137	138	137	137	136	136	139	139
5WQ	4000K Lumens	7,445	14,797	21,966	29,108	36,849	43,633	51,250	59,417	66,705
	BUG Rating	B3-U0-G2	B4-U0-G2	B5-U0-G3	B5-U0-G4	B5-U0-G4	B5-U0-G5	B5-U0-G5	B5-U0-G5	B5-U0-G5
	Lumens per Watt	131	137	137	137	137	136	136	139	139
SLL/ SLR	4000K Lumens	6,132	12,187	18,091	23,973	30,348	35,936	42,210	48,935	54,938
	BUG Rating	B1-U0-G2	B2-U0-G3	B2-U0-G3	B3-U0-G4	B3-U0-G5	B3-U0-G5	B3-U0-G5	B3-U0-G5	B3-U0-G5
	Lumens per Watt	108	113	113	113	113	112	112	114	114
RW	4000K Lumens	7,340	14,587	21,653	28,694	36,325	43,013	50,522	58,573	65,757
	BUG Rating	B3-U0-G1	B3-U0-G2	B4-U0-G2	B4-U0-G2	B5-U0-G3	B5-U0-G3	B5-U0-G4	B5-U0-G4	B5-U0-G4
	Lumens per Watt	129	135	135	135	135	134	134	137	137
AFL	4000K Lumens	7,183	14,276	21,193	28,084	35,552	42,098	49,448	57,327	64,359
	BUG Rating	B1-U0-G1	B2-U0-G2	B2-U0-G2	B3-U0-G2	B3-U0-G3	B3-U0-G3	B3-U0-G4	B3-U0-G4	B4-U0-G4
	Lumens per Watt	126	132	132	132	132	131	131	134	134

* Nominal data for 70 CRI. ** For additional performance data, please reference the Galleon Supplemental Performance Guide.

McGraw-Edison GALN Galleon II

Performance Table, Drive Current "D" (1200mA)

Galleon II IES Files | Supplemental Lumen Tables

Number of Light Squares		1	2	3	4	5	6	7	8	9
Nominal Power (Watts)		65	125	184	245	309	368	433	493	552
Input Current @ 120V		0.546	1.041	1.535	2.082	2.578	3.070	3.619	4.114	4.605
Input Current @ 208V		0.318	0.610	0.893	1.219	1.504	1.786	2.113	2.397	2.679
Input Current @ 240V		0.276	0.523	0.758	1.046	1.282	1.516	1.806	2.041	2.274
Input Current @ 277V		0.241	0.460	0.662	0.920	1.133	1.325	1.593	1.807	1.987
Input Current @ 347V		0.187	0.370	0.543	0.740	0.915	1.085	1.285	1.459	1.628
Input Current @ 480V		0.138	0.269	0.391	0.537	0.663	0.782	0.932	1.057	1.173
Optics										
T1	4000K Lumens	7,814	15,529	23,053	30,549	38,672	45,793	53,787	62,358	70,007
	BUG Rating	B3-U0-G1	B4-U0-G2	B4-U0-G2	B5-U0-G3	B5-U0-G3	B5-U0-G4	B5-U0-G4	B5-U0-G4	B5-U0-G4
	Lumens per Watt	120	124	125	125	125	124	124	126	127
T2	4000K Lumens	7,872	15,645	23,225	30,777	38,962	46,135	54,189	62,824	70,530
	BUG Rating	B1-U0-G2	B2-U0-G3	B3-U0-G4	B3-U0-G4	B3-U0-G5	B3-U0-G5	B4-U0-G5	B4-U0-G5	B4-U0-G5
	Lumens per Watt	121	125	126	126	126	125	125	127	128
T2R	4000K Lumens	7,977	15,854	23,535	31,188	39,482	46,751	54,913	63,663	71,472
	BUG Rating	B1-U0-G2	B2-U0-G2	B3-U0-G3	B3-U0-G4	B3-U0-G4	B3-U0-G4	B4-U0-G5	B4-U0-G5	B4-U0-G5
	Lumens per Watt	123	127	128	127	128	127	127	129	129
T3	4000K Lumens	7,762	15,427	22,901	30,348	38,418	45,491	53,433	61,947	69,546
	BUG Rating	B2-U0-G2	B3-U0-G3	B3-U0-G3	B3-U0-G4	B4-U0-G4	B4-U0-G5	B4-U0-G5	B4-U0-G5	B4-U0-G5
	Lumens per Watt	119	123	124	124	124	124	123	126	126
T3R	4000K Lumens	8,010	15,920	23,632	31,317	39,645	46,944	55,139	63,925	71,767
	BUG Rating	B1-U0-G2	B2-U0-G3	B3-U0-G4	B3-U0-G4	B3-U0-G5	B3-U0-G5	B4-U0-G5	B4-U0-G5	B4-U0-G5
	Lumens per Watt	123	127	128	128	128	128	127	130	130
T4FT	4000K Lumens	7,810	15,522	23,043	30,535	38,655	45,772	53,763	62,330	69,976
	BUG Rating	B1-U0-G2	B2-U0-G3	B3-U0-G4	B3-U0-G4	B3-U0-G5	B4-U0-G5	B4-U0-G5	B4-U0-G5	B4-U0-G5
	Lumens per Watt	120	124	125	125	125	124	124	126	127
T4W	4000K Lumens	7,833	15,568	23,110	30,625	38,769	45,907	53,921	62,513	70,182
	BUG Rating	B2-U0-G2	B3-U0-G3	B3-U0-G4	B3-U0-G5	B4-U0-G5	B4-U0-G5	B4-U0-G5	B4-U0-G5	B4-U0-G5
	Lumens per Watt	121	125	126	125	125	125	125	127	127
SL2	4000K Lumens	7,813	15,528	23,052	30,547	38,670	45,790	53,784	62,354	70,003
	BUG Rating	B2-U0-G2	B3-U0-G3	B3-U0-G4	B3-U0-G4	B4-U0-G5	B4-U0-G5	B4-U0-G5	B4-U0-G5	B4-U0-G5
	Lumens per Watt	120	124	125	125	125	124	124	126	127
SL3	4000K Lumens	7,758	15,419	22,889	30,332	38,398	45,468	53,406	61,916	69,511
	BUG Rating	B1-U0-G2	B2-U0-G3	B3-U0-G4	B3-U0-G4	B3-U0-G5	B3-U0-G5	B3-U0-G5	B4-U0-G5	B4-U0-G5
	Lumens per Watt	119	123	124	124	124	124	123	126	126
SL4	4000K Lumens	7,662	15,228	22,605	29,955	37,921	44,903	52,742	61,146	68,646
	BUG Rating	B1-U0-G3	B2-U0-G3	B2-U0-G4	B3-U0-G5	B3-U0-G5	B3-U0-G5	B3-U0-G5	B3-U0-G5	B4-U0-G5
	Lumens per Watt	118	122	123	122	123	122	122	124	124
5NQ	4000K Lumens	8,169	16,235	24,101	31,938	40,431	47,874	56,232	65,193	73,190
	BUG Rating	B3-U0-G1	B3-U0-G2	B4-U0-G2	B5-U0-G2	B5-U0-G3	B5-U0-G3	B5-U0-G4	B5-U0-G4	B5-U0-G4
	Lumens per Watt	126	130	131	130	131	130	130	132	133
5MQ	4000K Lumens	8,210	16,316	24,221	32,097	40,632	48,113	56,512	65,517	73,554
	BUG Rating	B3-U0-G2	B4-U0-G2	B5-U0-G3	B5-U0-G3	B5-U0-G4	B5-U0-G4	B5-U0-G5	B5-U0-G5	B5-U0-G5
	Lumens per Watt	126	131	132	131	131	131	131	133	133
5WQ	4000K Lumens	8,192	16,282	24,170	32,029	40,546	48,011	56,393	65,379	73,399
	BUG Rating	B3-U0-G2	B4-U0-G2	B5-U0-G3	B5-U0-G4	B5-U0-G4	B5-U0-G5	B5-U0-G5	B5-U0-G5	B5-U0-G5
	Lumens per Watt	126	130	131	131	131	130	130	133	133
SLL/ SLR	4000K Lumens	6,747	13,410	19,906	26,379	33,394	39,542	46,445	53,846	60,451
	BUG Rating	B1-U0-G2	B2-U0-G3	B2-U0-G4	B3-U0-G4	B3-U0-G5	B3-U0-G5	B3-U0-G5	B3-U0-G5	B4-U0-G5
	Lumens per Watt	104	107	108	108	108	107	107	109	110
RW	4000K Lumens	8,076	16,050	23,826	31,574	39,970	47,329	55,592	64,450	72,356
	BUG Rating	B3-U0-G1	B4-U0-G2	B4-U0-G2	B5-U0-G3	B5-U0-G3	B5-U0-G4	B5-U0-G4	B5-U0-G4	B5-U0-G5
	Lumens per Watt	124	128	129	129	129	129	128	131	131
AFL	4000K Lumens	7,904	15,709	23,320	30,902	39,120	46,323	54,410	63,079	70,817
	BUG Rating	B1-U0-G1	B2-U0-G2	B3-U0-G2	B3-U0-G3	B3-U0-G3	B3-U0-G3	B3-U0-G4	B4-U0-G4	B4-U0-G4
	Lumens per Watt	122	126	127	126	127	126	126	128	128

* Nominal data for 70 CRI. ** For additional performance data, please reference the Galleon Supplemental Performance Guide.

Control Options

0-10V (DIM)
This fixture is offered standard with 0-10V dimming driver(s). The DIM option provides 0-10V dimming wire leads for use with a lighting control panel or other control method.

Photocontrol (BPC, PR and PR7)
Optional button-type photocontrol (BPC) and photocontrol receptacles (PR and PR7) provide a flexible solution to enable "dusk-to-dawn" lighting by sensing light levels. Advanced control systems compatible with NEMA 7-pin standards can be utilized with the PR7 receptacle.

After Hours Dim (AHD)
This feature allows photocontrol-enabled luminaires to achieve additional energy savings by dimming during scheduled portions of the night. The dimming profile will automatically take effect after a "dusk-to-dawn" period has been calculated from the photocontrol input. Specify the desired dimming profile for a simple, factory-shipped dimming solution requiring no external control wiring. Reference the After Hours Dim supplemental guide for additional information.

Dimming Occupancy Sensor (SPB and MS/DIM-LXX)
These passive infrared (PIR) sensors are factory installed in the luminaire housing. When the SPB (FSP-321 or FSP-311) or MS/DIM (FSP-211) sensor options are selected, the occupancy sensor is connected to a dimming driver and the luminaire dims when no motion is detected. After a set period of time, the luminaire turns off, and when motion is detected, the luminaire returns to full light output. Both sensors are factory preset to dim down to approximately 10% power with a time delay of five minutes. The MS/DIM sensor requires the FSIR-100 programming tool to adjust factory defaults. The SPB sensor default parameters are listed in the table below and can be configured utilizing the Sensor Configuration mobile application for iOS and Android devices. The SPB/X is configured to control only the specified number of light squares (See SPB/X Availability Table below.) An integral photocontrol can be activated with the app for "dusk-to-dawn" control or daylight harvesting - the factory default is off. Four sensor colors are available; Bronze, Black, Gray and White, and are automatically selected based on the luminaire finish as indicated by the table below.

SPB sensor finish matched to luminaire finish		
Luminaire Finish		SPB Sensor Finish*
WH	White	White
BK	Black	Black
GM	Graphite Metallic	Black
BZ	Bronze	Bronze
AP	Gray	Gray
DP	Dark Platinum	Gray

*SPB bezel color automatically selected based on luminaire finish

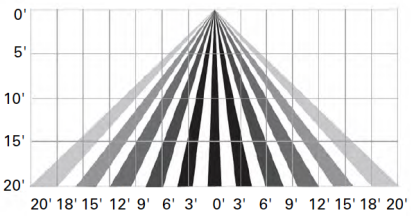
SPB/X Availability Table	
Fixture Square Count	Available SPB/X Square Count
1	Not Available
2	Not Available
3	Not Available
4	2
5	2 or 3
6	3
7	2, 3, 4 or 5
8	2, 3, 5 or 6
9	3 or 6

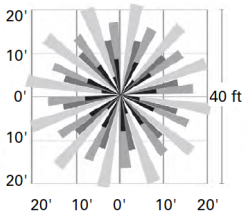
Default Program Settings (Out of the Box Functionality)

Occupancy Sensor				
Setting	MS/DIM	SPB	WaveLinx Lite (WLS4 / WLS2)	WaveLinx (WPS)
High Mode %	100%	100%	100%	100%
Low Mode %	10%	10%	50%	50%
Time Delay	5 min	5 min	15 min	15 min
Cut Off Delay	1 hr	1 hr	Disabled	Disabled
Photocell Enabled	No	No	Yes	Yes

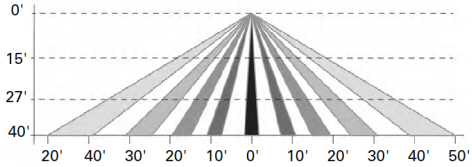
WaveLinx Wireless Control and Monitoring System
Operates on a wireless mesh network based on IEEE 802.15.4 standards enabling wireless control of outdoor lighting. WaveLinx (WPS2 to WPS4) outdoor wireless sensors offer passive infrared (PIR) occupancy and photocell for closed loop daylight harvesting, and can be factory or field-installed. Sensors are factory preset to dim down to 50% after 15 minutes of no motion detected. Two lens options are available for mounting heights of 7' to 40'. Use the WaveLinx mobile application for set-up and configuration. At least one Wireless Area Controller (WAC) is required for full functionality and remote communication (including adjustment of any factory pre-sets). WaveLinx Lite (WLS4 and WLS2) outdoor wireless sensors provide PIR occupancy and photocell for closed loop daylight harvesting, and can be factory or field-installed. Sensors are factory preset to dim down to 50% after 15 minutes of no motion detected. Two lens options are available for mounting heights of 7' to 40'. Use the WaveLinx Lite mobile application for set-up and configuration. WAC not required. WaveLinx Outdoor Control Module (WOLC-7P-10A) accessory provides a photocontrol enabling astronomic or time-based schedules to provide ON, OFF and dimming control of fixtures utilizing a 7-PIN receptacle. The out-of-box functionality is ON at dusk and OFF at dawn.

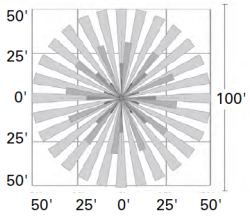
For mounting heights up to 15' (WPS2 and WLS2)





For mounting heights up to 40' (WPS4 and WLS4)





AirMesh (DIM10)
AirMesh integrated wireless controls system includes factory installed DIM10 Synapse control module and FSP-201 motion sensor; requires additional AirMesh components for operation. Contact Synapse at www.synapsewireless.com for product support, warranty and terms and conditions.

Cooper Lighting Solutions
1121 Highway 74 South
Peachtree City, GA 30269
P: 770-486-4800
www.cooperlighting.com

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Specifications and dimensions subject to change without notice.

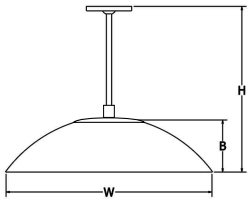
DEMI

Exterior Pendant

G Lighting
9777 Reavis Park Drive
St. Louis, MO 63123
800.331.2425 or 314.631.6000
sales@glighting.com www.glighting.com

GENERAL SPECIFICATION

LED: High efficiency mid-power LEDs.
LED Dimming: Standard 1% 0-10V dimming.
Listing: ETL listed for wet locations.
Canopy: Matches fixture finish. Hanger 3 includes 10.125“ dia by 2.625” H spinning.
Driver: Max remote driver installation distance 25ft from fixture body.
Acrylic: Acrylic is UL-94 HB Flame Class rated.
Finish: Highly durable oven cured no VOC premium powder coat. Inner finish matches outer fixture finish.
Surge Protection: External surge protector provided as standard.





SAMPLE CATALOG NUMBER:
GL-5360- E- BLK- 1- A 038

MODEL NO.	LAMPING	FINISH	HANGER	OPTIONS	OVERALL HEIGHT
GL-5360 10lbs W 24” 4.5kg B 6” H 38”	**A.** 1LED30 **B.** 1LED35 **C.** 1LED40 **D.** 1LED30 **E.** 1LED35 **F.** 1LED40 **G.** 1LED30 **H.** 1LED35 **I.** 1LED40	Standard: Powder Coat **BLK**-Black **BL**-Blue **GR**-Gray **LG**-Light Gray **BE**-Beige **PAB**-Antique Brass **PA**-Painted Aluminum **PTC**-Painted Copper **WH**-White **DBZ**-Dark Bronze **NSN**-New Satin Nickel **BRN**-Brown **RD**-Red **CH**-Champagne **RG**-Reed Green **SG**-Sungold **GM**-Gun Metal **POR**-Oil Rubbed Bronze **PG**-Pine Green **DO**-Deep Orange **PV**-Purple Violet **NB**-Navy Blue Textured Powder **TLV**-Light Verdigris **TWH**-Textured White **TBL**-Textured Black **TS**-Textured Silver **TBZ**-Textured Bronze **TST**-Stone Premium: **SA**-Satin Aluminum **CUSTOM POWDERCOAT**	**1.** Stem Mount Remote Driver  Drivers mounted remotely **3.** Stem Mount Oversized Canopy  Drivers mounted inside oversized canopy	**A.** No Options **EL.** Emergency LED Must be remotely mounted in a controlled environment with an area temperature range of 32°-131°F. Specify 120 or 277 voltage.	Specify overal height in inches
GL-5361 10lbs W 30” 4.5kg B 7 7/16” H 40”					
GL-5362 15lbs W 48” 7kg B 12” H 44”					

All Dimensions are nominal.

Light Source Definition

Downlight Output

Code	LED	Total Wattage	Delivered Lumens	Kelvin	CRI
A	1LED30	15W	1695	3000	80
B	1LED35	15W	1695	3500	80
C	1LED40	15W	1695	4000	80
D	1LED30	26W	2906	3000	80
E	1LED35	26W	2906	3500	80
F	1LED40	26W	2906	4000	80
G	1LED30	39W	4359	3000	80
H	1LED35	39W	4359	3500	80
I	1LED40	39W	4359	4000	80

Universal Voltage unless otherwise specified.
Fixture tested with white inner finish. Non-white inner finishes will reduce lumen output.

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G Lighting products are union made.

Project		**Catalog #**		**Type**	
Prepared by		**Notes**		**Date**	



Sure-Lites

EUX Series

Universal Mount Edge Lit LED Exit Sign

Typical Applications

Office • Education • Healthcare • Hospitality • Retail • Manufacturing

Interactive Menu

- Dimensions and Mounting Details page 2
- Product Specifications page 3
- Technical Data page 4
- Product Warranty

Product Certification

UL CERTIFIED

T20 Certified to California Title 20 Appliance Database

Product Features

damp location

-10° to 40°C operating temperature range

NYC COMPLIANT

Top Product Features

- Universal mounting: standard surface ceiling, wall and end mount and recessed mount
- All aluminum housing
- LED source
- Single/Double sided lenses with white and mirrored inserts
- Field installable chevrons
- Self-diagnostics available with battery back-up models
- Dual voltage input 120/277 VAC

Ordering Information

SAMPLE ORDER NUMBER: **EUX7RSD-MUL**

Series	Face Options	Exit Color	Housing Color	Options	Examples
EUX6=AC only	**[Blank]**=Universal **1**=Single Face **2**=Double Face	**R**=Red **G**=Green	**[Blank]**=Brushed Aluminum **WH**=White **BK**=Black	**[Blank]**=None **2C**=Two Circuit	**EUX6R, EUX61RWH** **EUX6G, EUX6GBK** **EUX6R-2C, EUX62GWH2C**
			Notes (1) Custom finishes available. Contact the factory to confirm finish availability and lead time.	**Notes** (2) The 2C / Two circuit option does not accept two hot circuits.	

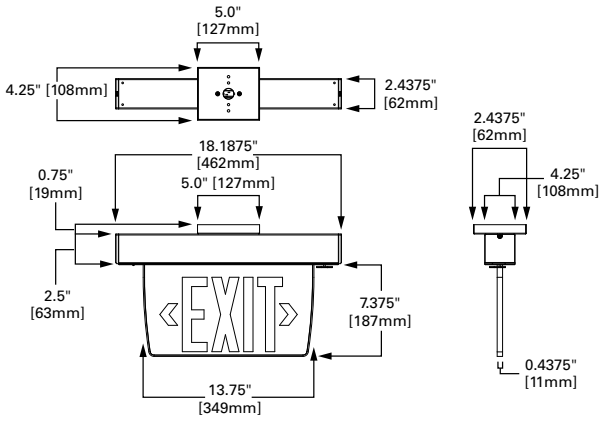
Series	Face Options	Exit Color	Housing Color	Self-diagnostics	Examples
EUX7=Self-powered (battery back-up)	**[Blank]**=Universal **1**=Single Face **2**=Double Face	**R**=Red **G**=Green	**[Blank]**=Brushed Aluminum **WH**=White **BK**=Black	**[Blank]**=No self-diagnostics **SD**=Self-diagnostics	**EUX7R, EUX7G, EUX71R, EUX71G** **EUX7RSD, EUX72WHSD, EUX7GSD, EUX7GBKSD**
			Notes (1) Custom finishes available. Contact the factory to confirm finish availability and lead time.		

Notes: **EUXFAI**=Fire alarm interface module (ordered separately; field installed).
- **MUL**=mullion mount (inverted sign) option. Add "-MUL" as a suffix.

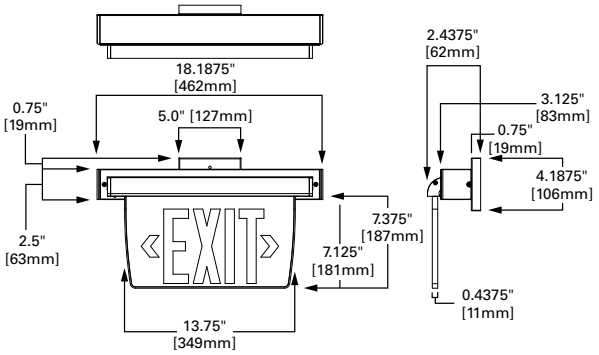
Shipping Information: The EUX housings and lens panels are shipped in separate boxes.

Dimensional and Mounting Details

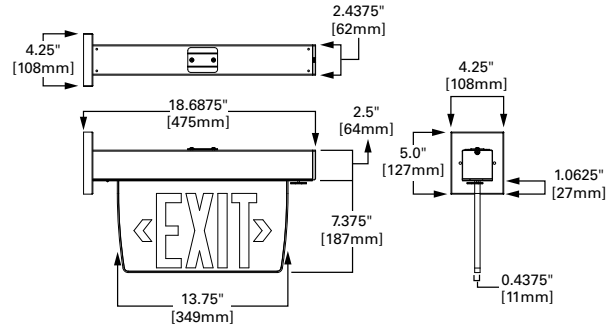
Surface Ceiling Mount



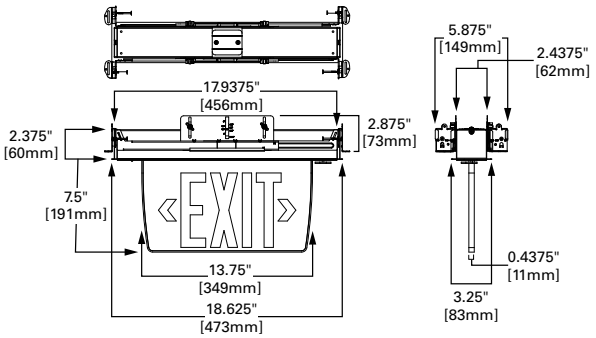
Surface Wall Mount



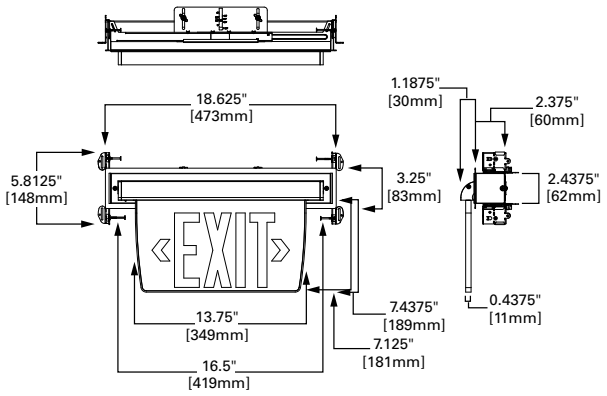
End Mount



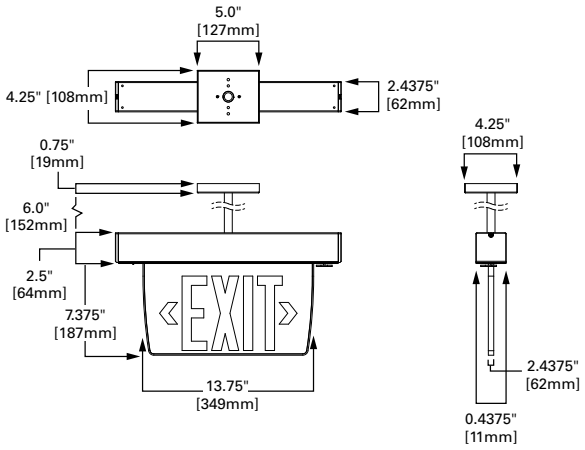
Recessed Ceiling Mount



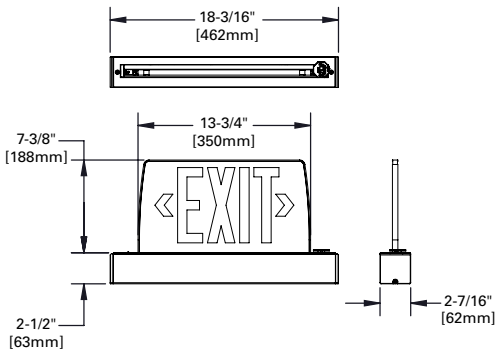
Recessed Wall Mount



With Optional 6" Pendant Kit



Mullionl Mount



Product Specifications

Electrical

- Dual Voltage Input, 120/277 VAC, 60 Hz
- EZ key external battery disconnect
- 10°C to 40°C (50°F to 104°F) operating range
- Self-Diagnostic System option
- Long life LED light source
- Fully recharged in 24 hours
- Solid-state Voltage Limited Charger
- Solid-state Switching
- Brownout Circuit
- Low-Voltage Disconnect
- Overload/Short Circuit Protection
- Test Switch/Power Indicator Light
- Photocell Test Switch (requires accessory laser for activation)
- Two circuit (-2C) option available for AC only
- Fire alarm interface (FAI) option available for self-powered

Battery

- Sealed nickel cadmium
- Maintenance-free
- 24-hour full recharge time

Housing Construction

- All aluminum housing
- All mounting options are standard: surface, recessed, end, ceiling and wall
- Available in brushed aluminum, white or black
- Halo Got Nail hangar bars included for recessed applications
- Convenient 1/2" knockouts on top and end of fixture
- Mullion mount option available for all versions (-MUL)
- The EUX housings and lens panels are shipped in separate boxes.

Trim/Lens for Universal

- High impact acrylic panel
- Available with red or green letters
- Single and double sided lenses included
- Clear, mirror insert and white insert options included
- Field installed and NFPA 101 compliant chevron directional indicators included
- No Tools required for “snap-in” installation
- Pre-specified chevron lens kits available for an enhanced aesthetic

Trim/Lens Kit for Single or Double

- High impact acrylic panel
- Available with red or green letters
- Clear, mirror insert, and white insert options included
- Field configurable for single (61,71) or double (62,72) sided
- Field installed and NFPA 101 compliant chevron directional indicators included
- No tools required for “snap-in” construction

Warranty

- Fixture: 5-year
- Battery: 7-year pro-rata

Energy and Performance Data

Maximum power consumption under all charge conditions:

LED Exits - Red

Input Power	Input Current (Max.):	Power Factor:
120V = 0.9W	120V = 0.08A	120V = 0.11
277V = 1.1W	277V = 0.08A	277V = 0.08

LED Exits - Green

Input Power	Input Current (Max.):	Power Factor:
120V = 1.3W	120V = 0.08A	120V = 0.2
277V = 1.5W	277V = 0.08A	277V = 0.1

Technical Data

Lamps
Optimized for energy efficiency and aesthetic appearance, the EUX series Exit uses super bright, long life LED lamps to illuminate the exit lens.

Housing
Die cast and extruded aluminum housing that mounts in any application. Available in white, black or brushed aluminum finishes. Housing has conduit knockouts on top and side for easy AC wiring connections. Fully adjustable Halo Got Nail hangar bars make recessed installation easy. EUX is fully compatible with grid or hard ceilings as well as 2 x 4 wall constructions.

Trim/Lens
The EUX lens kit is truly universal and includes the materials needed to field construct all options. The high-impact, clear acrylic lens panel comes with three pieces to allow configuration of single or double sided options on the job site. In addition to the clear option, both mirror and white inserts are standard, along with NFPA 101 compliant chevrons. The lens installation requires no tools and snaps easily into place.

Pre-specified chevron lens kits (arrow right/left, double arrow) are also available as an option. This kit also includes white and mirror inserts, is fully NFPA compliant and requires no tools for installation. Single and double sided configurations can only support one or two sided - not both.

EZ Key Power Disconnet (self-powered only)
The Patented EZ key is an external battery disconnect that allows the product to be shipped with the battery connected internally. This prevents battery drain during the construction cycle to insure that the battery isn't damaged and is fully charged for inspection. EZ Key also saves the labor of internally connecting the battery after construction is complete.

Solid-State Charger (self-powered only)
Supplied with a 120/277 VAC, voltage regulated solid-state charger. Immediately upon restoration of AC current after a power failure, the charger provides a high charge rate. Solid-state circuitry recharges the battery following a power failure in accordance with UL 924.

Brownout Circuit (self-powered only)
The brownout circuit on Sure-Lites' exits monitors the flow of AC current to the exit and activates the emergency lighting system when a predetermined reduction of AC power occurs. This dip in voltage will cause most ballasted fixtures to extinguish causing loss of normal lighting even though a total power failure has not occurred.

Solid-State Transfer (self-powered only)
The EUX Series exit incorporates solid state switching which eliminates corroded and pitted contacts or mechanical failures associated with relays. The switching circuit is designed to detect a loss of AC voltage and automatically energizes the LED lamps. Upon restoration of AC power, the emergency circuit will switch off and the charger will automatically fully recharge the battery within 24 hours.

Test Switch/Power Indicator Light (self-powered only)
Conveniently located combination Test Switch/Power Indicator Light allows for manual verification of proper operation of the transfer circuit and emergency lamps.

Photocell Test Switch
Allows verification of proper operation of the transfer circuit and emergency lamps with a laser pointer (laser is sold as an accessory). The emergency lamps will test for 30 seconds when activated.

Self-Diagnostics
The self-diagnostic software will automatically perform all tests required by UL924, and NFPA101. The system indicates the status of the emergency light at all times using the LED indicator. A 90 minute battery power (emergency mode) simulation test will occur once every 12 months. A 30 second battery power simulation test will occur every 30 days. The Solid-State microprocessor based system has the ability to accurately detect and warn of system failures, plus it incorporates all of the standard electronic features that sets Sure- Lites apart from its competition. Self-diagnostic software automatically performs all testing required by the NFPA 101 Life Safety Code and systematically calibrates itself in the field, reducing installation labor and eliminating manual calibration errors.

Sealed Nickel Cadmium Battery (self-powered only)
Sure-Lites sealed nickel cadmium batteries are maintenance-free with a life expectancy of 7 years. The sealed rechargeable nickel cadmium battery offers high discharge rates and stable performance over a wide range of temperatures.

"2C" Option (AC Only)
Note: "2C" cannot accept 2 active hots
The "2C" Option enables the Exits to operate per the requirements of UL 924 when connected simultaneously to both normal and emergency power circuits (two circuit operation–UL Category FTBR–Emergency Lighting and Power Equipment). The "2C" Option alters the standard Exit such that it complies with and is UL Listed under the FTBR Category. This option should only be used for exits which are intended to be connected simultaneously to normal and emergency power circuits, but cannot support two hot inputs. Only one of the normal or emergency circuits can be powered. If both are powered simultaneously, it will make the Exit inoperable. Both circuits have universal 120/277 VAC standard.

Warranty
All Sure-Lites' products are backed by a firm five-year warranty against defects in material and workmanship. Maintenance-free, long-life, sealed nickel cadmium batteries carry a seven-year pro-rata warranty.

Cooper Lighting Solutions
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Peachtree City, GA 30269
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Specifications and dimensions subject to change without notice.

Project		**Catalog #**		**Type**	
Prepared by		**Notes**		**Date**	



Sure-Lites

EUX Series

Universal Mount Edge Lit LED Exit Sign

Typical Applications

Office • Education • Healthcare • Hospitality • Retail • Manufacturing

Interactive Menu

- Dimensions and Mounting Details page 2
- Product Specifications page 3
- Technical Data page 4
- Product Warranty

Product Certification

UL CERTIFIED

T20 Certified to California Title 20 Appliance Database

Product Features

damp location

-10° to 40°C operating temperature range

NYC COMPLIANT

Top Product Features

- Universal mounting: standard surface ceiling, wall and end mount and recessed mount
- All aluminum housing
- LED source
- Single/Double sided lenses with white and mirrored inserts
- Field installable chevrons
- Self-diagnostics available with battery back-up models
- Dual voltage input 120/277 VAC

Ordering Information

SAMPLE ORDER NUMBER: **EUX7RSD-MUL**

Series	Face Options	Exit Color	Housing Color	Options	Examples
EUX6=AC only	**[Blank]**=Universal **1**=Single Face **2**=Double Face	**R**=Red **G**=Green	**[Blank]**=Brushed Aluminum **WH**=White **BK**=Black	**[Blank]**=None **2C**=Two Circuit	**EUX6R, EUX61RWH** **EUX6G, EUX6GBK** **EUX6R-2C, EUX62GWH2C**
			Notes (1) Custom finishes available. Contact the factory to confirm finish availability and lead time.	**Notes** (2) The 2C / Two circuit option does not accept two hot circuits.	

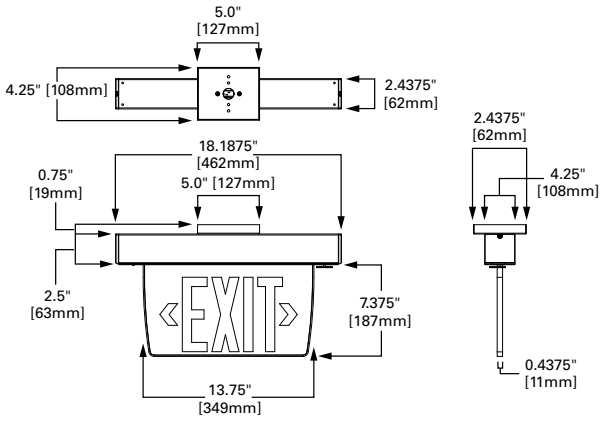
Series	Face Options	Exit Color	Housing Color	Self-diagnostics	Examples
EUX7=Self-powered (battery back-up)	**[Blank]**=Universal **1**=Single Face **2**=Double Face	**R**=Red **G**=Green	**[Blank]**=Brushed Aluminum **WH**=White **BK**=Black	**[Blank]**=No self-diagnostics **SD**=Self-diagnostics	**EUX7R, EUX7G, EUX71R, EUX71G** **EUX7RSD, EUX72WHSD, EUX7GSD, EUX7GBKSD**
			Notes (1) Custom finishes available. Contact the factory to confirm finish availability and lead time.		

Notes: **EUXFAI**=Fire alarm interface module (ordered separately; field installed).
- **MUL**=mullion mount (inverted sign) option. Add "-MUL" as a suffix.

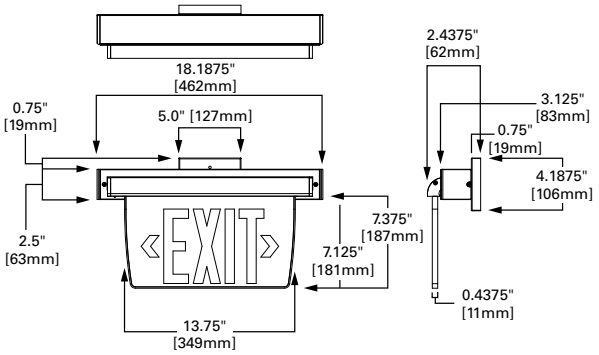
Shipping Information: The EUX housings and lens panels are shipped in separate boxes.

Dimensional and Mounting Details

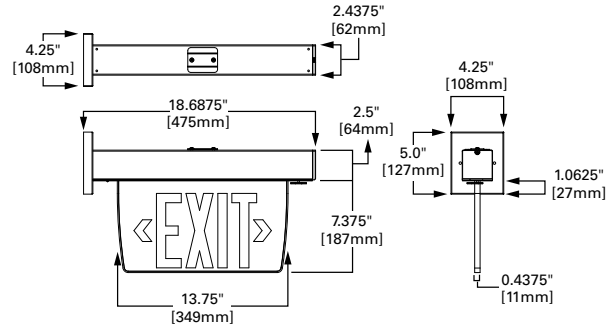
Surface Ceiling Mount



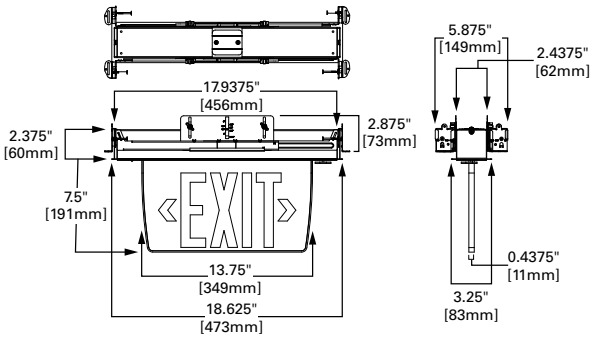
Surface Wall Mount



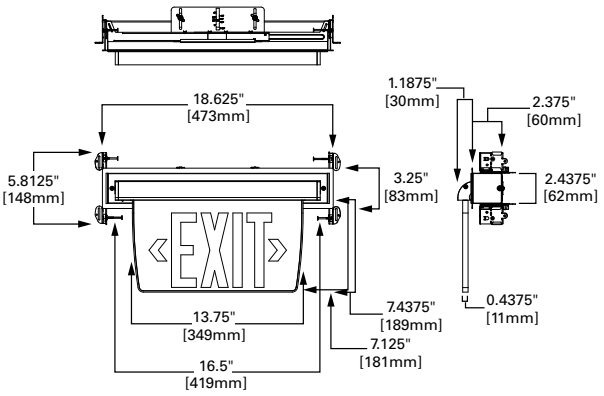
End Mount



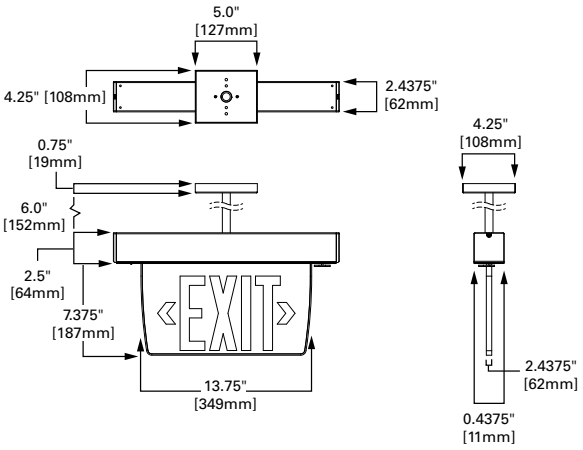
Recessed Ceiling Mount



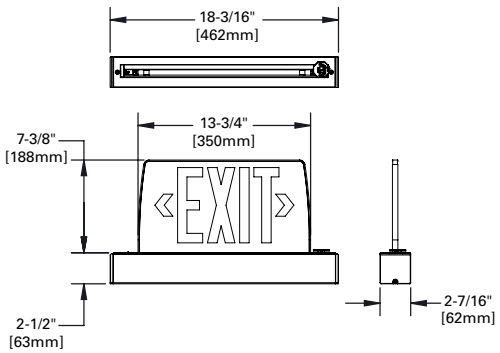
Recessed Wall Mount



With Optional 6" Pendant Kit



Mullionl Mount



Product Specifications

Electrical

- Dual Voltage Input, 120/277 VAC, 60 Hz
- EZ key external battery disconnect
- 10°C to 40°C (50°F to 104°F) operating range
- Self-Diagnostic System option
- Long life LED light source
- Fully recharged in 24 hours
- Solid-state Voltage Limited Charger
- Solid-state Switching
- Brownout Circuit
- Low-Voltage Disconnect
- Overload/Short Circuit Protection
- Test Switch/Power Indicator Light
- Photocell Test Switch (requires accessory laser for activation)
- Two circuit (-2C) option available for AC only
- Fire alarm interface (FAI) option available for self-powered

Battery

- Sealed nickel cadmium
- Maintenance-free
- 24-hour full recharge time

Housing Construction

- All aluminum housing
- All mounting options are standard: surface, recessed, end, ceiling and wall
- Available in brushed aluminum, white or black
- Halo Got Nail hangar bars included for recessed applications
- Convenient 1/2" knockouts on top and end of fixture
- Mullion mount option available for all versions (-MUL)
- The EUX housings and lens panels are shipped in separate boxes.

Trim/Lens for Universal

- High impact acrylic panel
- Available with red or green letters
- Single and double sided lenses included
- Clear, mirror insert and white insert options included
- Field installed and NFPA 101 compliant chevron directional indicators included
- No Tools required for “snap-in” installation
- Pre-specified chevron lens kits available for an enhanced aesthetic

Trim/Lens Kit for Single or Double

- High impact acrylic panel
- Available with red or green letters
- Clear, mirror insert, and white insert options included
- Field configurable for single (61,71) or double (62,72) sided
- Field installed and NFPA 101 compliant chevron directional indicators included
- No tools required for “snap-in” construction

Warranty

- Fixture: 5-year
- Battery: 7-year pro-rata

Energy and Performance Data

Maximum power consumption under all charge conditions:

LED Exits - Red

Input Power	Input Current (Max.):	Power Factor:
120V = 0.9W	120V = 0.08A	120V = 0.11
277V = 1.1W	277V = 0.08A	277V = 0.08

LED Exits - Green

Input Power	Input Current (Max.):	Power Factor:
120V = 1.3W	120V = 0.08A	120V = 0.2
277V = 1.5W	277V = 0.08A	277V = 0.1

Technical Data

Lamps
Optimized for energy efficiency and aesthetic appearance, the EUX series Exit uses super bright, long life LED lamps to illuminate the exit lens.

Housing
Die cast and extruded aluminum housing that mounts in any application. Available in white, black or brushed aluminum finishes. Housing has conduit knockouts on top and side for easy AC wiring connections. Fully adjustable Halo Got Nail hangar bars make recessed installation easy. EUX is fully compatible with grid or hard ceilings as well as 2 x 4 wall constructions.

Trim/Lens
The EUX lens kit is truly universal and includes the materials needed to field construct all options. The high-impact, clear acrylic lens panel comes with three pieces to allow configuration of single or double sided options on the job site. In addition to the clear option, both mirror and white inserts are standard, along with NFPA 101 compliant chevrons. The lens installation requires no tools and snaps easily into place.

Pre-specified chevron lens kits (arrow right/left, double arrow) are also available as an option. This kit also includes white and mirror inserts, is fully NFPA compliant and requires no tools for installation. Single and double sided configurations can only support one or two sided - not both.

EZ Key Power Disconnet (self-powered only)
The Patented EZ key is an external battery disconnect that allows the product to be shipped with the battery connected internally. This prevents battery drain during the construction cycle to insure that the battery isn't damaged and is fully charged for inspection. EZ Key also saves the labor of internally connecting the battery after construction is complete.

Solid-State Charger (self-powered only)
Supplied with a 120/277 VAC, voltage regulated solid-state charger. Immediately upon restoration of AC current after a power failure, the charger provides a high charge rate. Solid-state circuitry recharges the battery following a power failure in accordance with UL 924.

Brownout Circuit (self-powered only)
The brownout circuit on Sure-Lites' exits monitors the flow of AC current to the exit and activates the emergency lighting system when a predetermined reduction of AC power occurs. This dip in voltage will cause most ballasted fixtures to extinguish causing loss of normal lighting even though a total power failure has not occurred.

Solid-State Transfer (self-powered only)
The EUX Series exit incorporates solid state switching which eliminates corroded and pitted contacts or mechanical failures associated with relays. The switching circuit is designed to detect a loss of AC voltage and automatically energizes the LED lamps. Upon restoration of AC power, the emergency circuit will switch off and the charger will automatically fully recharge the battery within 24 hours.

Test Switch/Power Indicator Light (self-powered only)
Conveniently located combination Test Switch/Power Indicator Light allows for manual verification of proper operation of the transfer circuit and emergency lamps.

Photocell Test Switch
Allows verification of proper operation of the transfer circuit and emergency lamps with a laser pointer (laser is sold as an accessory). The emergency lamps will test for 30 seconds when activated.

Self-Diagnostics
The self-diagnostic software will automatically perform all tests required by UL924, and NFPA101. The system indicates the status of the emergency light at all times using the LED indicator. A 90 minute battery power (emergency mode) simulation test will occur once every 12 months. A 30 second battery power simulation test will occur every 30 days. The Solid-State microprocessor based system has the ability to accurately detect and warn of system failures, plus it incorporates all of the standard electronic features that sets Sure- Lites apart from its competition. Self-diagnostic software automatically performs all testing required by the NFPA 101 Life Safety Code and systematically calibrates itself in the field, reducing installation labor and eliminating manual calibration errors.

Sealed Nickel Cadmium Battery (self-powered only)
Sure-Lites sealed nickel cadmium batteries are maintenance-free with a life expectancy of 7 years. The sealed rechargeable nickel cadmium battery offers high discharge rates and stable performance over a wide range of temperatures.

"2C" Option (AC Only)
Note: "2C" cannot accept 2 active hots
The "2C" Option enables the Exits to operate per the requirements of UL 924 when connected simultaneously to both normal and emergency power circuits (two circuit operation–UL Category FTBR–Emergency Lighting and Power Equipment). The "2C" Option alters the standard Exit such that it complies with and is UL Listed under the FTBR Category. This option should only be used for exits which are intended to be connected simultaneously to normal and emergency power circuits, but cannot support two hot inputs. Only one of the normal or emergency circuits can be powered. If both are powered simultaneously, it will make the Exit inoperable. Both circuits have universal 120/277 VAC standard.

Warranty
All Sure-Lites' products are backed by a firm five-year warranty against defects in material and workmanship. Maintenance-free, long-life, sealed nickel cadmium batteries carry a seven-year pro-rata warranty.

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Specifications and dimensions subject to change without notice.

Project		Catalog #		Type	
Prepared by		Notes		Date	



Sure-Lites

CX Series

Die-Cast Aluminum
Surface Mount LED
Exit Lighting

Typical Applications

Office • Education • Healthcare • Hospitality • Retail • Industrial • Manufacturing

Interactive Menu

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- Product Warranty

Product Certification

UL CERTIFIED OSHA

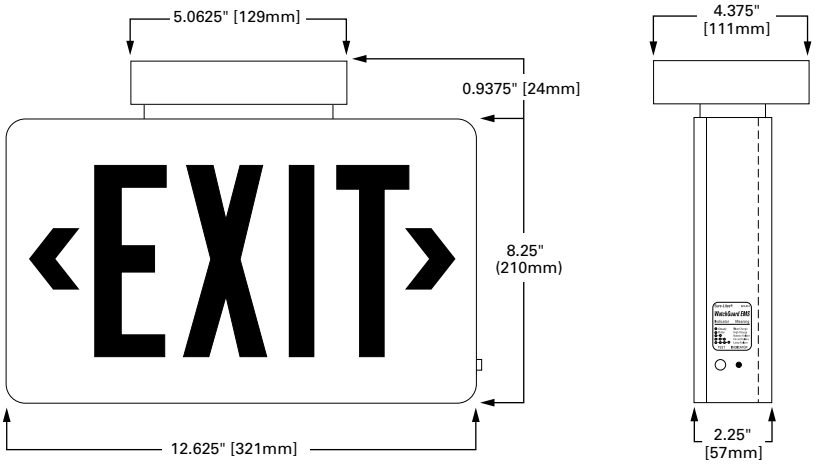
Product Features

damp location

Top Product Features

- Dual voltage input 120/277 VAC, 60 Hz
- 90 minutes of emergency run time with self-powered (battery backup) models
- Die-cast aluminum housing
- Die-cast canopy included
- Field selectable Red or Green LED illumination
- Laber savings self-diagnostics (CX7 only)

Dimensional Details



Ordering Information

SAMPLE ORDER NUMBER: **CX71SD, CX72WHSD, CX6SB7**

Family	Series	Face Options	Housing Finish	Options
CX=Die Cast Aluminum Exit, LED	**6**=AC only	**1**=Single **2**=Double **S**=Open Face for Signage (1)	**[Blank]**=Brushed Aluminum Face w/Black Housing **WH**=White **BK**=Black	**[Blank]**=No additional options **2C**=Two Circuit Option (CX6 only)
		Notes (1) Consult factory for additional custom signage options.		**Notes** (2) Consult factory for additional custom signage options.

Family	Series	Face Options	Housing Finish	Options
CX=Die Cast Aluminum Exit, LED	**7**=Self Powered (3)	**1**=Single **2**=Double **S**=Open Face for Signage (4)	**[Blank]**=Brushed Aluminum Face w/Black Housing **WH**=White **BK**=Black	**SD**=Self-diagnostics (standard) with Fire Alarm Interface Capability (CX7 only)
	Notes (3) Self-powered units have battery backup to provide 90 minutes of run time when A/C power is lost. Units must be connected to A/C power for standard operation.	**Notes** (4) Consult factory for additional custom signage options.		

Options for non-EXIT signs

Signage Options (Color)	Signage Options (Common Signs)
Blank =EXIT sign **R**=Red letter, Red LED **G**=Green letter, Green LED	**Blank**=EXIT sign **1** ="AREA OF RESCUE" **2** ="SALIDA" **3** ="STAIRS" **4** ="AREA OF REFUGE" **5** ="IN USE" **6** ="NOT AN EXIT" **7** =(WHEEL CHAIR SYMBOL) **8** ="X-RAY ON" **9** ="LASER IN USE" **10** ="DO NOT ENTER"

Available Accessories (Order Separately)

Protection Devices	Pendant Kit
WG10=Wall mount wire guard **WGS11**=Ceiling or End mount wire guard **VS1**=Polycarbonate Vandal Shield **VS1WP**=Polycarbonate Vandal Shield, Weather Proof	**CAX18PKWH**=18" Pendant Kit, White **CAX18PKBK**=18" Pendant Kit, Black **CAX18PKHTWH**=18" Hang True Pendant Kit, White

Product Specifications

Electrical

- **General Features**
- Field selectable red and green sign capability standard on all units (units shipped red, field convert to green with supplied parts)
- Dual Voltage Input 120/277 VAC,60Hz
- **AC Only**
- Optional 2C (Two circuit, FTBR) available in 120/277 VAC in standard and emergency operation. 2C models does not accept two hot circuits.
- **Self Powered ***
- Sure-Lites EZ Key patented external battery disconnect feature – prevents unnecessary battery drainage, saves on installation time
- Solid-state Voltage Limited Charger
- Brownout Circuit
- Low-Voltage Disconnect
- Test Switch/Power Indicator Light
- Standard 24 hour recharge time (max)
- Self-Diagnostic feature standard for CX7 self-powered series

Housing Construction

- Die cast aluminum housing
- Injection molded, color stable, high impact polycarbonate faces
- Die cast canopy included (for mounting convenience only, no electrical components in canopy)
- Universal pattern knockouts on rear of single face housing for direct mounting to junction box
- Knockout provided on housing for surface attachment
- Exit can be universally mounted: ceiling, wall or end
- Choice of three finishes: black housing with brushed aluminum face, white housing with white face or black housing with black face
- NFPA 101 compliant knockout chevrons allow quick conversion to directional signs
- Single and double faced signs available, order separately

Code Compliance

- UL 924 Listed
- UL Damp Location (0-40° C)
- Life Safety NFPA 101
- NEC/OSHA
- Most State and Local Codes
- Suitable for Floor Proximity Installation
- UL Listed for 2C (FTBR)

Lamp Data

- AC LED: Red and green LED lamps provide uniform diffused illumination
- DC: Red and green LED DC lamps (Brighter in emergency mode)

Warranty

- Exit – 5 year
- Battery: 7-Year pro-rata

*Self-powered units have battery backup to provide 90 minutes of run time when A/C power is lost. Units must be connected to A/C power for standard operation.

Technical Data

Lamps
- Long life, red and green LEDs, provide uniform diffuse illumination of the exit face
- Low operating costs and no maintenance required
- Consumes on average less than one watt.

Housing Construction
- Die cast aluminum with Brushed Aluminum face and black trim standard.
- Optional finishes include White and Black.
- NFPA 101 compliant knockout chevrons for easy conversion to directional sign.
- Universal pattern knockouts are in the back of the single face housing for direct mounting to junction box.
- Die cast aluminum alloy canopy included for universal mounting. Canopy is included for mounting convenience only–no electrical components in canopy.

Lens
- Lenses for the CX Series Exits are made from durable, impact resistant polycarbonate.
- All exit faces are designed with full 3/4" stroke snap-out or snap-in chevron directional indicators to insure maximum visibility and compliance with the latest codes.
- Units come with red lenses installed and green lenses included for field selectable red or green signs.

Sure-Lites EZ Key External Battery Disconnect (Self Powered Only*)
- The Patented EZ key is an external battery disconnect that allows the product to be shipped with the battery connected internally.
- This prevents battery drain during the construction cycle to insure that the battery isn't damaged and is fully charged for inspection.
- EZ Key also saves the labor of internally connecting the battery after construction is complete.

*Self-powered units have battery backup to provide 90 minutes of run time when A/C power is lost. Units must be connected to A/C power for standard operation.

Brownout Circuit (Self Powered Only*)
- Monitors the flow of AC current
- Activates the emergency lighting system when a predetermined reduction/dip of AC power occurs (a dip in voltage will cause most ballasted products to extinguish, causing loss of normal lighting even though a total power failure has not occurred)

Solid-State Transfer (Self Powered Only*)
- The CX Series Exit incorporates solid-state switching which eliminates corroded and pitted contacts or mechanical failures associated with relays. The switching circuit is designed to detect a loss of AC voltage and automatically energizes the lamps using DC power. Upon restoration of AC power, the DC power will be disconnected and the charger will automatically recharge the battery.

Low Voltage Disconnect (Self Powered Only*)
- When the battery's terminal voltage falls, the low-voltage circuitry disconnects the lighting load. The disconnect remains in effect until normal utility power is restored, preventing deep battery discharge.

Test Switch/Power Indicator Light (Self Powered Only*)
- A test switch located on the side of the exit permits the activation of the emergency circuit for a complete operational systems check. The Power Indicator Light provides visual assurance that the AC power is on.

Sealed Nickel Cadmium Battery (Self Powered Only*)
- Sure-Lites sealed nickel cadmium batteries are maintenance-free with a life expectancy of 10 years. The sealed rechargeable nickel cadmium battery offers high discharge rates and stable performance over a wide range of temperatures, from 0-40° C. The specially designed re-sealable vent automatically controls cell pressure, assuring safety and reliability. This battery is best suited for harsh ambient temperatures because the electrolyte is not active in the electrochemical process.

"2C" (AC Only)
- The "2C" Option enables the Exits to operate per the requirements of UL 924 when connected simultaneously to both normal and emergency power circuits (two circuit operation–UL Category FTBR–Emergency Lighting and Power Equipment). The "2C" Option alters the standard Exit such that it complies with and is UL Listed under the FTBR Category. This option should only be used for exits which are intended to be connected simultaneously to normal and emergency power circuits, but cannot support two hot inputs. Only one of the normal or emergency circuits can be powered. If both are powered simultaneously, it will make the Exit inoperable. Both circuits have universal 120/277 VAC standard.

Self Diagnostics Option (Self Powered Only*)
- The self-diagnostic unit will automatically perform all tests required by UL924, and NFPA 101. The system indicates the status of the exit at all times using the LED indicator near the test switch on the side of the unit. A 90 minute battery power (emergency mode) simulation test will occur randomly once every 12 months. A 30 second battery power simulation test will occur every 30 days.

Photocell Test Switch
- Allows verification of proper operation of the transfer circuit and emergency lamps with a laser pointer (laser is sold as an accessory). The emergency lamps will test for 30 seconds when activated.



Laser tester

Part Number = LASER

(sold separately)

Warranty
- All Sure-Lites' products are backed by a firm five-year warranty against defects in material and workmanship. Maintenance-free, long-life, sealed nickel cadmium batteries carry a seven-year pro-rata warranty.

Energy and Performance Data

Maximum power consumption under all charge conditions:

AC Only, 120V - Red

Amps:	Watts:	Power Factor:
0.07	0.98	0.12

AC Only, 120V - Green

Amps:	Watts:	Power Factor:
0.07	1.02	0.13

AC Only, 277V - Red

Amps:	Watts:	Power Factor:
0.07	1.04	0.06

AC Only, 277V - Green

Amps:	Watts:	Power Factor:
0.07	1.12	0.06

Self Powered, 120V - Red

Amps:	Watts:	Power Factor:
0.07	0.98	0.12

Self Powered, 120V - Green

Amps:	Watts:	Power Factor:
0.07	1.00	0.13

Self Powered, 277V - Red

Amps:	Watts:	Power Factor:
0.07	1.03	0.06

Self Powered, 277V - Green

Amps:	Watts:	Power Factor:
0.07	1.09	0.05

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Project		Catalog #		Type	
Prepared by		Notes		Date	



Sure-Lites

CX Series

Die-Cast Aluminum
Surface Mount LED
Exit Lighting

Typical Applications

Office • Education • Healthcare • Hospitality • Retail • Industrial • Manufacturing

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- Product Warranty

Product Certification

UL CERTIFIED OSHA

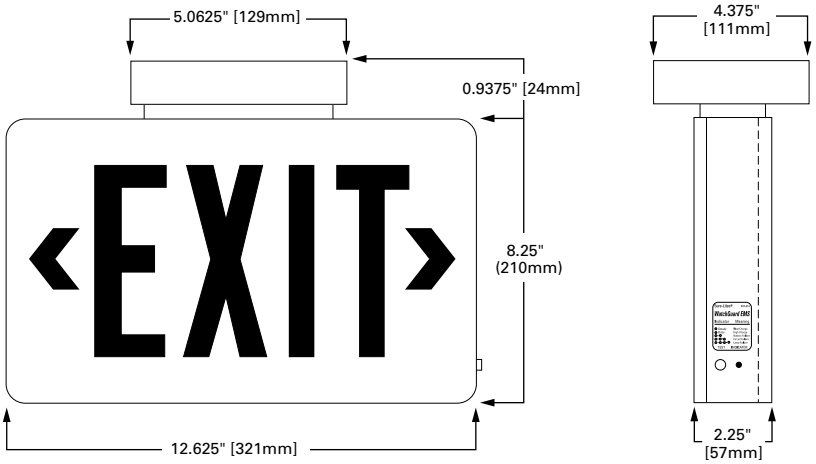
Product Features

damp location

Top Product Features

- Dual voltage input 120/277 VAC, 60 Hz
- 90 minutes of emergency run time with self-powered (battery backup) models
- Die-cast aluminum housing
- Die-cast canopy included
- Field selectable Red or Green LED illumination
- Laber savings self-diagnostics (CX7 only)

Dimensional Details



Ordering Information

SAMPLE ORDER NUMBER: **CX71SD, CX72WHSD, CX6SB7**

Family	Series	Face Options	Housing Finish	Options
CX=Die Cast Aluminum Exit, LED	**6**=AC only	**1**=Single **2**=Double **S**=Open Face for Signage [1]	**[Blank]**=Brushed Aluminum Face w/Black Housing **WH**=White **BK**=Black	**[Blank]**=No additional options **2C**=Two Circuit Option (CX6 only)
		Notes (1) Consult factory for additional custom signage options.		**Notes** (2) Consult factory for additional custom signage options.

Family	Series	Face Options	Housing Finish	Options
CX=Die Cast Aluminum Exit, LED	**7**=Self Powered [3]	**1**=Single **2**=Double **S**=Open Face for Signage [4]	**[Blank]**=Brushed Aluminum Face w/Black Housing **WH**=White **BK**=Black	**SD**=Self-diagnostics (standard) with Fire Alarm Interface Capability (CX7 only)
	Notes (3) Self-powered units have battery backup to provide 90 minutes of run time when A/C power is lost. Units must be connected to A/C power for standard operation.	**Notes** (4) Consult factory for additional custom signage options.		

Options for non-EXIT signs

Signage Options (Color)	Signage Options (Common Signs)
Blank =EXIT sign **R**=Red letter, Red LED **G**=Green letter, Green LED	**Blank**=EXIT sign **1** ="AREA OF RESCUE" **2** ="SALIDA" **3** ="STAIRS" **4** ="AREA OF REFUGE" **5** ="IN USE" **6** ="NOT AN EXIT" **7** =(WHEEL CHAIR SYMBOL) **8** ="X-RAY ON" **9** ="LASER IN USE" **10** ="DO NOT ENTER"

Available Accessories (Order Separately)

Protection Devices	Pendant Kit
WG10=Wall mount wire guard **WGS11**=Ceiling or End mount wire guard **VS1**=Polycarbonate Vandal Shield **VS1WP**=Polycarbonate Vandal Shield, Weather Proof	**CAX18PKWH**=18" Pendant Kit, White **CAX18PKBK**=18" Pendant Kit, Black **CAX18PKHTWH**=18" Hang True Pendant Kit, White

Product Specifications

Electrical

- **General Features**
- Field selectable red and green sign capability standard on all units (units shipped red, field convert to green with supplied parts)
- Dual Voltage Input 120/277 VAC,60Hz
- **AC Only**
- Optional 2C (Two circuit, FTBR) available in 120/277 VAC in standard and emergency operation. 2C models does not accept two hot circuits.
- **Self Powered ***
- Sure-Lites EZ Key patented external battery disconnect feature – prevents unnecessary battery drainage, saves on installation time
- Solid-state Voltage Limited Charger
- Brownout Circuit
- Low-Voltage Disconnect
- Test Switch/Power Indicator Light
- Standard 24 hour recharge time (max)
- Self-Diagnostic feature standard for CX7 self-powered series

Housing Construction

- Die cast aluminum housing
- Injection molded, color stable, high impact polycarbonate faces
- Die cast canopy included (for mounting convenience only, no electrical components in canopy)
- Universal pattern knockouts on rear of single face housing for direct mounting to junction box
- Knockout provided on housing for surface attachment
- Exit can be universally mounted: ceiling, wall or end
- Choice of three finishes: black housing with brushed aluminum face, white housing with white face or black housing with black face
- NFPA 101 compliant knockout chevrons allow quick conversion to directional signs
- Single and double faced signs available, order separately

Code Compliance

- UL 924 Listed
- UL Damp Location (0-40° C)
- Life Safety NFPA 101
- NEC/OSHA
- Most State and Local Codes
- Suitable for Floor Proximity Installation
- UL Listed for 2C (FTBR)

Lamp Data

- AC LED: Red and green LED lamps provide uniform diffused illumination
- DC: Red and green LED DC lamps (Brighter in emergency mode)

Warranty

- Exit – 5 year
- Battery: 7-Year pro-rata

*Self-powered units have battery backup to provide 90 minutes of run time when A/C power is lost. Units must be connected to A/C power for standard operation.

Technical Data

Lamps
- Long life, red and green LEDs, provide uniform diffuse illumination of the exit face
- Low operating costs and no maintenance required
- Consumes on average less than one watt.

Housing Construction
- Die cast aluminum with Brushed Aluminum face and black trim standard.
- Optional finishes include White and Black.
- NFPA 101 compliant knockout chevrons for easy conversion to directional sign.
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Lens
- Lenses for the CX Series Exits are made from durable, impact resistant polycarbonate.
- All exit faces are designed with full 3/4" stroke snap-out or snap-in chevron directional indicators to insure maximum visibility and compliance with the latest codes.
- Units come with red lenses installed and green lenses included for field selectable red or green signs.

Sure-Lites EZ Key External Battery Disconnect (Self Powered Only*)
- The Patented EZ key is an external battery disconnect that allows the product to be shipped with the battery connected internally.
- This prevents battery drain during the construction cycle to insure that the battery isn't damaged and is fully charged for inspection.
- EZ Key also saves the labor of internally connecting the battery after construction is complete.

*Self-powered units have battery backup to provide 90 minutes of run time when A/C power is lost. Units must be connected to A/C power for standard operation.

Brownout Circuit (Self Powered Only*)
- Monitors the flow of AC current
- Activates the emergency lighting system when a predetermined reduction/dip of AC power occurs (a dip in voltage will cause most ballasted products to extinguish, causing loss of normal lighting even though a total power failure has not occurred)

Solid-State Transfer (Self Powered Only*)
- The CX Series Exit incorporates solid-state switching which eliminates corroded and pitted contacts or mechanical failures associated with relays. The switching circuit is designed to detect a loss of AC voltage and automatically energizes the lamps using DC power. Upon restoration of AC power, the DC power will be disconnected and the charger will automatically recharge the battery.

Low Voltage Disconnect (Self Powered Only*)
- When the battery's terminal voltage falls, the low-voltage circuitry disconnects the lighting load. The disconnect remains in effect until normal utility power is restored, preventing deep battery discharge.

Test Switch/Power Indicator Light (Self Powered Only*)
- A test switch located on the side of the exit permits the activation of the emergency circuit for a complete operational systems check. The Power Indicator Light provides visual assurance that the AC power is on.

Sealed Nickel Cadmium Battery (Self Powered Only*)
- Sure-Lites sealed nickel cadmium batteries are maintenance-free with a life expectancy of 10 years. The sealed rechargeable nickel cadmium battery offers high discharge rates and stable performance over a wide range of temperatures, from 0-40° C. The specially designed re-sealable vent automatically controls cell pressure, assuring safety and reliability. This battery is best suited for harsh ambient temperatures because the electrolyte is not active in the electrochemical process.

"2C" (AC Only)
- The "2C" Option enables the Exits to operate per the requirements of UL 924 when connected simultaneously to both normal and emergency power circuits (two circuit operation–UL Category FTBR–Emergency Lighting and Power Equipment). The "2C" Option alters the standard Exit such that it complies with and is UL Listed under the FTBR Category. This option should only be used for exits which are intended to be connected simultaneously to normal and emergency power circuits, but cannot support two hot inputs. Only one of the normal or emergency circuits can be powered. If both are powered simultaneously, it will make the Exit inoperable. Both circuits have universal 120/277 VAC standard.

Self Diagnostics Option (Self Powered Only*)
- The self-diagnostic unit will automatically perform all tests required by UL924, and NFPA 101. The system indicates the status of the exit at all times using the LED indicator near the test switch on the side of the unit. A 90 minute battery power (emergency mode) simulation test will occur randomly once every 12 months. A 30 second battery power simulation test will occur every 30 days.

Photocell Test Switch
- Allows verification of proper operation of the transfer circuit and emergency lamps with a laser pointer (laser is sold as an accessory). The emergency lamps will test for 30 seconds when activated.



Laser tester

Part Number = LASER

(sold separately)

Warranty
- All Sure-Lites' products are backed by a firm five-year warranty against defects in material and workmanship. Maintenance-free, long-life, sealed nickel cadmium batteries carry a seven-year pro-rata warranty.

Energy and Performance Data

Maximum power consumption under all charge conditions:

AC Only, 120V - Red

Amps:	Watts:	Power Factor:
0.07	0.98	0.12

AC Only, 120V - Green

Amps:	Watts:	Power Factor:
0.07	1.02	0.13

AC Only, 277V - Red

Amps:	Watts:	Power Factor:
0.07	1.04	0.06

AC Only, 277V - Green

Amps:	Watts:	Power Factor:
0.07	1.12	0.06

Self Powered, 120V - Red

Amps:	Watts:	Power Factor:
0.07	0.98	0.12

Self Powered, 120V - Green

Amps:	Watts:	Power Factor:
0.07	1.00	0.13

Self Powered, 277V - Red

Amps:	Watts:	Power Factor:
0.07	1.03	0.06

Self Powered, 277V - Green

Amps:	Watts:	Power Factor:
0.07	1.09	0.05

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SECTION 26 65 30

EXTERIOR LIGHTING FIXTURES

PART 1 – GENERAL

1.01 REQUIREMENTS

A. Furnish and install exterior lighting fixtures in accordance with the parameters shown on the drawings and herein specified.

B. Units shall be Underwriters Laboratories listed; complete with optical assembly, ballast(s), lamp(s) and accessories.

1.02 SUBMITTALS

A. Fixture submittals shall be tendered in bound form (booklet, ring binder, etc.) with a designated, indexed section for each type.

B. Fixture descriptions shall include:

1. Alphanumeric designation (matching bidding documents) and corresponding generic description.

2. Product literature (including that for associated ballasts and lamps), edited and highlighted to indicate all parameters set forth in the bidding documents.

3. Photometric data.

4. Dimensioned drawings.

PART 2 – PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. McGraw-Edison, Hubbel, Lumark, Widelight or approved equal.

2.02 DESCRIPTION

A. General:

1. Refer to Fixture Schedule shown on drawings.

2. Refer to Specification Sections 266551 and 266552 regarding lamp(s) and ballast(s), respectively.

D. Pole mounted, area/site light:

1. Optical assembly:

a. Low profile, one piece , die-cast aluminum housing, 3G vibration rated design, extruded aluminum frame, stainless steel fasteners, 2.5 mil 5-stage polyester power coat finish.

2. Optics:

a. High efficiency solid state LED optics, injection-molded acrylic light bar, 4000 K, nominal 70 CRI, IP66 enclosure rating.

b. LED driver hard-mounted to die-cast aluminum back casting, lighting circuit module designed to withstand 10kV transient line surge, 50,000 hours of life with 70% lumen maintenance, operating temperature from -30 degrees Celsius to 50 degrees Celsius.

3. Mounting:

a. Cast aluminum 6 inch arm, square pole arm and round pole adapter, 2.5 mil 5-stage polyester power coat finish.

B. Accessories:

1. Connectors, strain-relief bushing, heavy gauge steel trunion, corrosion resistant materials.

PART 3 – EXECUTION

3.01 INSTALLATION

A. Arrange units as shown on the drawings, complete with necessary adjustments to aiming positions to assure coordinated light levels.

B. Units shall be complete with design features and all necessary accessories required to properly attach the unit to the associated pole/cross arm.

C. Support units level and plumb from the pole with cross arm supports, (multiple attachments as required).

D. Thoroughly clean fixture exposed surfaces, optical assembly and lamps.

END OF SECTION

SECTION 26 65 71

EXTERIOR LIGHTING POLES

PART 1 – GENERAL

1.01 REQUIREMENTS

A. Furnish and install light poles in accordance with the parameters shown on the drawings and herein specified.

B. Wind velocity shall be calculated for the appropriate wind velocity plus a 30% gust factor, per AASHTO Standard Specification for Structural Supports for Highway Signs, Luminaires and Traffic Signals.

C. Effective projected area (EPA) is the actual area adjusted with the appropriate drag coefficient (shape factor) to result in an equivalent area having a drag coefficient equal to one (1).

PART 2 – PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. HAPCO, Valmont Structures, or approved equal.

2.02 DESCRIPTION

A. Pole:

a. Round straight shaft:

1) Extruded, seamless 6063 alloy aluminum tubing, heat treated to T6 temper, drilled or equipped with top tenon to accommodate luminaire, satin-brushed finish.

2) Hand-hole:

a) Reinforced, 18 inches above base, 2-3/8 inches x 4-1/2 inches minimum.

b. Anchor bolts:

1) ASTM F1554, Grade 55, galvanized, 4 inch thread minimum, hooked end.

2) Two hex nuts, two flat washers, one lock washer.

PART 3 – EXECUTION

3.01 INSTALLATION

A. Arrange poles as shown on the drawings, complete with dimensional adjustments per lighting manufacturer's recommendations.

B. Support units level and plumb and install per manufacturer's directions.

END OF SECTION

SECTION 26 67 26

ADDRESSABLE FIRE ALARM AND DETECTION SYSTEM

PART 1 – GENERAL

1.01 REQUIREMENTS

A. Furnish and install addressable fire alarm and detection systems in accordance with the parameters shown on the drawings and herein specified.

B. Refer to Section 266010, *General Provisions*, for requirements relative to submittals, accessories and components, installation, removals, protection, maintenance manual, systems demonstration and instruction; additionally, Section 266111, *Conduit Systems*, and Section 266120, *Wire and Cables* shall apply.

C. Systems shall be the modular, microprocessor based, distributed intelligence, field programmable (password protected), direct current, supervised type; Underwriters Laboratories listed, National Fire Protection Association standard(s) compliant; complete with control module master, analog interface card, controllable relay module(s), controllable signal module(s), power supply, addressable input and output modules, and intelligent initiating devices, interface module(s), enclosure, printer, cellular communicator, signaling devices, voice control system, Class A wiring system(s) and all interconnecting wire ways, fiber, wiring and other related equipment to provide complete connectivity to central control station.

1.02 GUARANTEE

A. The system shall be guaranteed to be free from defects in materials and workmanship for a period of one year from the date of final acceptance by the Owner, during which time all above-mentioned defects shall be corrected and all services incidental to proper performance shall be provided free of charge.

1.03 SOURCE AND SERVICE

A. Source:

1. Basic systems components and associated accessories shall be furnished by a single manufacturer through a factory authorized distributor.

B. Service:

1. Systems service shall be available from the manufacturer’s authorized distributor (located within a 50 mile radius) 24 hours of every day via qualified factory trained technicians.

1.04 QUALIFICATIONS

A. Licensed for the installation of fire alarm systems in the State of New York.

B. Authorized installer for product supplied. Authorization letter from manufacturer required upon request.

1.06 FABRICATION DRAWINGS, MATERIAL LISTS AND EQUIPMENT SUBMITTALS

A. Prior to installation, submit fabrication drawings, material lists and equipment submittals (shop drawings) for approval in accordance with the following:

1. Complete description (manufacturer's cut sheets) data indicating UL listing for all network components.

2. Complete sequence of operation of all functions.

3. A list of every address of every device connected to a network node that is provided for purposes of alarm initiation, status monitoring, supervised notification appliance circuits and auxiliary control.

4. Complete wiring diagrams for components and interfaces to equipment supplied by others.

5. A listing of the manufacturer's representatives responsible for installation coordination and service.

6. Location of all controls, alarm actuating devices and notification appliance devices as shown on drawings.

PART 2 – PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. GE - EST, or approved equal.

2.02 DESCRIPTION

A. Control panel:

1. Control module master:

a. Polling module that contains system database, coordinates system polling, printer reports and output (device mapping), manual and override functions, input/output functions and analog signaling loops. Capable of supporting up to 2500 analog/addressable points.

b. Modular construction, field expandable and programmable, receptive to supervised, plug-in component boards.

c. Visual indication:

1) 168 character backlit, liquid crystal (LCD) display.

2) System Power LED.

3) Alarm LED.

4) Trouble LED.

5) Supervisory LED.

6) Monitor LED.

7) Ground Fault LED.

8) CPU Fault LED.

9) Test Point(s) LED.

d. Function switches:

1) Alarm Silence.

2) Scroll.

3) Drill/All Call.

4) Alarm Acknowledge.

5) Reset.

6) Trouble Silence.

7) Lamp Test.

8) Review.

e. Supervised, RS 232C port.

f. Real time clock:

1) Display (normal):

a) Time.

g. EST4 System.

2. Analog interface:

a. Data transmission interface between the control module master and 96 addressable devices and 94 intelligent modules.

b. Dedicated central processor unit (CPU) to provide power, processing and communications with up to 190 devices in 4 seconds or less and 3 seconds or less to detect an alarm condition.

3. Output modules:

a. Relay module:

1) 1 DPST relays.

2) Contact rating 2 amp at 24 VDC or 0.5 amp at 120 VAC.

3) Supervised.

4) Addressable.

5) EST Model SIGA-CR.

4. Power supply:

a. Input:

1) 120/220 VAC 3-wire (common neutral; internally fused main power).

2) Monitored by control master module.

b. Output:

1) One 24 VDC (1/2 amp) output to field devices.

2) One 5 VDC output to internal circuitry.

3) 2 power-limited 24 VDC (3.2 amps) NAC outputs.

c. Standby:

1) Batteries:

a) 12 VDC, sealed lead acid, gel type, 15 amp-hour minimum, (2 per system).

2) Dual-rate charger provides full recharge in 48 hours.

3) Automatic transfer of power when AC voltage drops below 85% input.

4) Battery test in loaded condition, performed locally or remotely.

5. Voice control system (one way voice communication notification and two way voice communication system):

a. Provide audio control module for the necessary alarm message/tone generation and main microphone connections:

1) Continuous supervision shall be provided along with specific information as to the type of failure should a problem occur (e.g., microphone trouble, tone trouble, etc.).

2) Audio outputs shall have individual gain control.

b. Provide a hand-held, push-to-talk microphone, recessed within panel enclosure with an LED microphone push-to-talk button which, when pressed, shall ready speaker circuits for transmission:

1) The microphone shall be supervised for disarrangement or failure.

c. Provide an audio control switch module for manual access to audio operations for authorized personnel; these switches and associated LED indicators shall be supervised for disarrangement or failure.

d. Provide an audio power amplifier with a self-contained, filtered 24 VDC power supply, transformer and amplifier monitor circuit:

1) The amplifiers shall provide a 25/75 volt RMS (75 watt) output with a frequency response of 200 Hz to 10,000 Hz.

2) The four speaker circuits shall be capable of supplying 25 volt RMS audio power for the system amplifiers.

e. Digitized tones for alarm (slow whoop) and auxiliary requirements (high/low, horn, chime, bell, etc.) with selectable temporal code shall be provided.

f. A prerecorded digitized voice message capability is to be provided for automatic transmission to building occupants during alarm conditions:

1) The automatic message player shall not rely on a tape or other mechanical means of transmitting the evacuation message.

2) A standard "all clear" and a standard "evacuation" message shall be provided under this Contract; however, the message player must be capable of transmitting a custom message up to five (5) minutes long; a self-contained speaker will provide testing of the message(s) without disturbing the occupants of the facility.

6. Enclosure:

a. Heavy gauge sheet steel (back-box and door cover assembly), flush or surface mounted as noted, piano hinge (left or right hand as shown), viewing slits (permitting component identification), dead front (except display and hold buttons), key lock.

B. Remote annunciator:

1. 168 character, backlit, alphanumeric display, system powered, local network connected, 352 stored messages.

2. Keypad:

a. Password protected control functions.

b. Menu driven display.

c. Acknowledge/audible/silence/system reset capabilities.

3. Enclosure:

a. Sheet metal with lockable door, surface/semi-recessed.

b. Clear lens in cover to view display.

4. EST Model 4-2ANN.

C. Cellular fire alarm communicator:

1. 5G cellular alarm communications transmitter, 10-24VDC input current, 115 mA to 85mA standby input current, two telco jacks, four programmable zone inputs, two form C relay outputs, metal enclosure.

2. NAPCO Security Technologies SLE-MAX2L.

D. Off premise signaling module:

1. Compact, internally housed, supervised, reverse polarity central station, connections for three separate off premises signaling modes, transmits trouble or supervisory conditions.

2. EST Model 3-OPS.

E. Printer:

1. Event and status logging, 9-pin, impact, dot matrix, 232 CPS, serial or parallel communications protocol, internal menu driven program, continuous tractor feed.

2. EST Model PT-IS.

F. Notification appliance circuit power extender:

1. 120 VAC input, four-3 amp (24 VDC) power limited outputs, 120 VDC sealed lead acid battery – 10 amp/hour minimum (2 per system), battery charger, earth detect module.

2. EST Model BPS10.

G. Initiating devices:

1. Detectors:

a. General:

1) Plug-in, twist/lock, (self-wiping contacts), lockable, screw terminals.

2) Integral LED alarm indicator; remote alarm indicator, relay base or audible base as noted and/or required, built-in test switch.

b. Photoelectric smoke, intelligent/analog:

1) Light scattering (light emitting diode source; light sensing photo diode receiver), easily cleanable, integral microprocessor based circuitry, corrosion resistant, self-diagnostics, history log, automatic device mapping, stand alone operation.

2) EST Model SIGA-PS.

c. Ionization smoke, intelligent/analog:

1) Dual chamber ionization type, 360º smoke entry and response, easily cleanable, integral microprocessor based circuitry, corrosion resistant, self-diagnostics, history log, automatic device mapping, stand alone operation.

2) EST Model SIGA-1S.

d. Thermal, rate compensated/fixed temperature, intelligent:

1) Dual thermistor sensor, shock and corrosion resistant, self-restoring, integral microprocessor based circuitry, self-diagnostics, history log, automatic device mapping, stand alone operation.

2) EST Model SIGA-HRS.

e. Photoelectric duct smoke detector:

1) Light scattering (light emitting diode source; light sensing photo diode receiver), easily cleanable, integral microprocessor based circuitry, corrosion resistant, self-diagnostics, history log, automatic device mapping, stand alone operation.

2) Transparent detector housing, cross sectional sampling tube (length as required), remote test station.

3) EST Model SIGA-SD.

e. Carbon monoxide detector:

1) Advance electrochemical CO sensing technology, automatic device mapping, non-volatile memory, electronic addressing, automatic day/night sensitivity adjustment, bicolor (green/red) status LED.

2) EST model SIGA-COD.

2. Manual station, intelligent:

a. Double action, "pull down" lever ("lock-in" operation subsequent to releasing a spring-loaded contact switch), key reset, molded (red) lexan housing with raised white lettering, integral microprocessor-based circuitry.

b. EST Model SIGA-278.

3. Addressable input module:

a. Microprocessor based, automatic device mapping, electronic addressing, non-volatile memory, stand alone operation.

b. Interface between normally open alarm, supervisory or monitor type dry contact initiating device circuits.

c. EST SIGA CT-1, SIGA CT-2, SIGA-MCT2.

H. Signaling devices:

1. Speaker/strobe:

a. Wall mounted, flush or surface (as applicable), speaker and strobe independently powered, ADA compliant, 25 or 70 VRMS operation from 1/4 to 2-watt output tap (field selectable), sound output of 87 db at 10 feet, 400 to 4000 Hz frequency response, sealed back construction, Xenon flash tube strobe, field selectable candela rating (15, 30, 75, 110), synchronized operation, clear lexan lens, rectangle white housing with red "FIRE" lettering.

b. EST Genesis G4 Series.

2. Speaker/strobe:

a. Ceiling mounted, flush or surface mounted (as applicable), speaker and strobe independently powered, ADA compliant, 25 or 70 VRMS operation from 1/2 to 4-watt output tap (field selectable), sound output of 87 db at 10 feet, 400 to 4000 Hz frequency response, sealed back construction, Xenon flash tube strobe, field selectable candela rating (15, 30, 75, 95; 95/115/150/177), synchronized operation, clear lexan lens, round white housing with red "FIRE" lettering.

b. EST Genesis GC Series.

3. Strobe:

a. Wall mounted, flush or surface (as applicable), ADA compliant, xenon flash tube strobe, field selectable candela rating (15, 30, 75, 110cd), self-synchronized, clear lexan lens, rectangle white housing with red "FIRE" lettering.

b. EST Genesis G1 Series.

4. Strobe:

a. Ceiling mounted, flush or surface (as applicable) ADA compliant xenon flash tube strobe, field selectable candela rating (15, 30, 75, 110cd), self-synchronized, clear lexan lens, round white housing with red "FIRE" lettering.

b. EST Genesis GCF Series.

5. Speaker:

a. Ceiling mounted, flush or surface mounted (as applicable), 70 vrms operation from ½ to 4 watt output tap (field selectable), sound output of 87db at 10 feet, round flush box.

b. EST Genesis Series.

6. Re-entrant speakers:

a. wall mounted, flush or surface mounted (as applicable), 70 vrms operation from 2, 4, 8 and 15 watt output tap (field selectable), sound output of 102 db at 10 feet, outdoor rated, rectangular white housing, weatherproof box.

b. EST 757 Series.

I. Control devices:

1. Addressable output:

a. Microprocessor based, automatic device mapping, non-volatile memory.

b. Intelligent control function interface utilizing form C relay; uniquely identifiable address.

c. EST Model SIGA-CCIS.

J. Magnetic hold-open:

1. 120 VAC, 24 VAC or 24 VDC, 0.2 amps, electromagnet assembly, aluminum baked polyester power paint housing, flush mounting, extended door armature assembly, doorplate and outlet box bracket.

2. 25 lb minimum holding force (3 watt maximum).

3. Floor or wall mounted (as applicable).

4. GE - EST 1500 Series.

K. Ductwork smoke detector housing:

1. Steel detector housing, red, cross-sectional air sampling tube (length as required), detector mounting base, remote test station and remote LED alarm/indicator.

2. EST SIGA-DH, 6261 Series, SIGA-DTS, SIGA-LED.

L. Isolate loop circuit protector:

1. Less than 23msec response time, once activated, continuously polls faulted loop, automatically restores loop upon fault removal, high impact polymer.

5. ADT Model SIGA-1M.

L. Extra materials:

1. Furnish extra materials that are packaged with protective covering for storage and identified with labels describing contents.

a. Provide quantity equal to 2% percent of amount of each type installed, but no fewer than 2 unit of each type.

1) Smoke Detectors, heat detectors, manual pull stations, duct smoke detector, monitor modules and control modules.

2) Notification appliances; speakers, speaker-strobes and strobes.

b. Ten extra keys for access to locked and tamperproof components.

M. Fire-Alarm Control Unit

1. The main control panel or remote control panel(s) shall be a multi-processor based networked system designed specifically for detection, and one/two-way emergency audio communications applications and shall be compatible with Autonomous Control Unit Communicator(s).

2. The control panel(s) shall include all required hardware, software and site-specific system programming to provide a complete and operational system. The control panel(s) shall be designed such that interactions between any applications can be configured, and modified using software provided by a single supplier. The control panel operational priority shall

assure that life safety takes precedence among the activities coordinated by the control panel.

3. The network of control panels shall include the following features.

1) Ability to download all network applications and firmware from the configuration computer on the network or at any control panel (network node) location.

1) Each control panel (network node) shall have an LCD display with common controls. The display shall be configurable to display the status of any and all combinations of alarm, supervisory, trouble, monitor, or group event messages.

2) Each LCD display on the system shall be capable of being programmed for control functions of any node or the entire network. The LCD display shall reside on the network as a node and continue to operate with a or with multiple faults fault on the network. An LCD can be programmed to be only operational when a node is operational in stand-alone mode, with a network fault.

3) The system program shall have a minimum of 100 system definable Service Groups to facilitate the testing of installed system based on the physical layout of the system. Service groups that disable entire circuits serving multiple floors or fire zones shall not be considered as equal.

4) Advanced Windows based programming with Program Version Reporting to document any and all changes made during system start-up or system commissioning. Time and date stamps of all modifications made to the program must be included to allow full retention of all previous program version data. The operator display shall clearly identify unacknowledged and acknowledged alarm, supervisory, trouble, and monitor status messages. The system shall provide the ability to download data from the analog/addressable detectors to a PC while the system is on-line and operational in the protected premises. The downloaded data may then be analyzed in a diagnostic program supplied by the system manufacturer.

5) Provide system reports that list a detailed description of the status of system parameters for corrective action or for preventive maintenance. Reports shall be displayed on the operator interface or be capable of being sent to a printer.

6) Provide an authorized operator with the ability to operate or modify system functions such as system time, date, passwords, holiday dates, restart the system and clear the control panel event history file.

7) Provide an authorized operator the ability to perform test functions within the installed system.

8) Supervision of system components, wiring, initiating devices and software shall be provided by the control panel. Failure or fault of system component or wiring shall be indicated by type and location on the LCD display. Software and processor operation shall be

independently monitored for failure. The system shall provide fail-safe operation, with multiple-levels of system operation.

4. Each network control panel shall be capable of:

    1) Supporting up to 2500 intelligent analog/addressable points.

    2) Supporting up to ten (10) intelligent addressable loops, each loop supporting 125 detectors and 125 modules, total of 250 points per loop.

    3) Supporting network connections up to 63 other control panels and annunciators.

    4) Support up 2 for a total of 60 dialers per Network with Contact ID or SIA format and TAP Pager protocol.

    5) Supporting multiple RS-232 communication ports and protocol.

    6) Supporting up to 1000 chronological history events.

    7) Total network response shall not exceed 3 seconds.

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

    1) The common control switches and with corresponding LEDs provided as minimum will be; Reset, Alarm Silence, Panel Silence, and Drill. It shall be able possible to add additional switches/LEDs as required.

    2) The main control panel shall have a display that is a 24 lines by 40 character graphic LCD and backlit when active.

    3) Each point shall have a custom event message of up to 40 charters, for a total of 80 characters. In addition instructional text messages shall be supported with a maximum of 2,000 characters each.

    4) Provide 8 simultaneous events to be displayed. The first seven (7) highest priority events in addition to the most recent event. The events shall be automatically placed in event types (Alarm, Supervisory, Monitor & Trouble) for easy access and it shall be possible to view the specific event type separately. Having to scroll through a mixed list of event types is not acceptable.

    5) Provide an internal audible signal with different programmable patterns to distinguish between alarm, supervisory, trouble and monitor conditions.

    6) Systems not capable of such a display on the main panel faceplate shall include a CRT/Monitor display meeting the above requirements and battery stand-by.

6. Audio One-Way Voice Communications:

1) The voice communication system shall be eight (8) channel audio evacuation system, to allow the ability to have eight simultaneous announcements/paging. The audio channels shall be designed as such:

   A. Mass Notification Message (HIGHEST PRIORITY)

   B. Fire Message

   C. Alert Message

   D. Stand-by Message

   E. Elevator Message

   F. Stairwell Message

   G. Security/Weather Threat

   H. Manual Paging

2) The system custom digital voice message shall provide a minimum of 100 minutes and be created as a .wav file format. All messages shall be able to be created on-site without any special tools or burning of chips. The system software shall be capable of selecting the required audio source signal for amplification. To enhance system survivability, each audio amplifier shall automatically provide an internally generated local 3-3-3, 1000 Hz temporal pattern output upon loss of the audio signal from the one-way emergency audio control unit, during an alarm condition. Systems not capable of supplying this back up tone per amplifier shall provide a physical back up amplifier per primary amplifier.

3) Audio amplifiers shall be power limited and protected from short circuits conditions on the audio circuit wiring. Each amplifier output shall be a supervised, dedicated, selectable 25/70 Vrms output.

4) Provide a standby audio amplifier per node that will automatically sense the failure of any primary amplifier installed in the same panel and replace the function of the failed amplifier.

7. Provide an Emergency Voice Communication System with the following design features:

   1) An audio control unit with Microphone for Paging. EST model number 3-ASU.

   2) Provide a switch for each evacuation signaling zone and “All-Call”, with "Page FIRE", "Auto" and “Page ALERT” positions identified and two LED status indicators for each audio visual evacuation signaling "zone", one red and one yellow.

   3) These LED's shall illuminate to indicate respectively:

      A. Evacuation signals activated (red).

      B. Trouble in audio (speaker) or visual (strobe) circuit(s) (yellow).

8. Provide 2-position switch for manually activate pre-recorded voice messages, with "Message Name" positions identified and one LED status indicators, one red. Provide minimum of 12 selector switches.

9. Instructions: Computer printout or typewritten instruction card mounted behind a plastic or glass cover in a stainless steel or aluminum frame. Include interpretation and describe appropriate response for displays and signals. Briefly describe the functional operation of the system under normal, alarm, and trouble conditions.

10. Circuits Requirements:

    1) Signaling Line Circuits for Network Communications:

        A. Class X.

    2) Signaling Line Circuits for Intelligent Analog Addressable Loop:

        A. Class A.

        B. No more than 100 detectors or 100 modules installed on a loop.

    3) Initiating Device Circuit:

        A. Class A.

    4) Notification Appliance Circuits:

        A. Class A.

        B. Maximum circuit loading to 2 amps for visuals.

PART 3 – EXECUTION

3.01 SYSTEM ARRANGEMENT

A. System arrangement shall be consistent with the component locations and riser diagram shown on the drawings.

B. Precise as-built mark-ups (illustrating actual field wiring arrangements, device addresses and control panel configurations) shall be submitted to the Engineer.

3.02 SYSTEM OPERATION

A. General:

1. Signal priority shall be as follows:

    a. Special suppression (CO^2, Halon, FM200, Intergen or other total flooding gaseous suppression system).

    b. Mass notification.

    c. Life safety/fire alarm.

    d. Other.

B. Mass notification/emergency communication system operation shall be initiated only from the building fire alarm control panel. No automatic operation shall be permitted.

1. Any operation of the mass notification/emergency communication system at the building fire alarm control panel shall be indicated on the central control station.

2. Any operation of the mass notification/emergency communication system from the central control station shall indicate at the building autonomous control unit/fire alarm control panel and local operations consoles that the respective building system is in mass notification/emergency communication mode.

3. Pre-recorded messages shall be selectable at the central control station and respective autonomous control unit/fire alarm control panel or local operations consoles and shall consist of a minimum of the following:

   a. Lockdown.

   b. Weather warning.

   c. All clear.

   d. Evacuation.

   e. Stand by.

   f. Test.

4. The system shall be capable of live voice page from the central control station to each respective building. Live voice paging inside the respective building shall be capable of being initiated from the autonomous control unit/fire alarm control panel or local operations consoles.

C. Fire Alarm System:

1. General:

   a. Intelligent devices address shall be electrically established via the control unit with the capacity for isolation (disarming) without affecting the influence of other components or system operations.

   b. Intelligent devices shall be dynamically supervised (continuously) by the control unit for internal and/or external trouble conditions.

   c. System control unit processor and software shall be independently supervised and arranged to insure alarm initiation and indication in event of failure.

   d. Intelligent/analog initiating devices sensitivity adjustment and measurement shall be achieved via the control unit.

   e. Alphanumeric annunciator(s) and remote printer (upon request) shall list:

1) Alarms (time, date, location).

2) Troubles (time, date, location).

3) Output functions status ("On", "Off").

4) Remote relay status ("On", "Off").

5) Intelligent smoke detector sensitivity.

6) Initiating device address.

7) Acknowledgements (time, date).

8) Signal silences (time, date).

9) Resets (time, date).

10) Battery voltage, AC voltage, charging current.

f. System programming shall include the capacity for time related functions.

g. The system shall be capable of being tested by one person by enabling the "walk-test" mode. Activating the "walk-test" mode shall:

1) Bypass central station connection.

2) Bypass control functions.

3) Cause a trouble condition at the control panel.

4) Reset the panel automatically after signaling is complete.

D. System response to the actuation of the initiating device(s) shall be programmed to conform to the parameters tabulated on the drawings, and unless otherwise noted, shall conform with the descriptions herein specified:

1. Alarm condition:

a. In response to an alarm condition:

1) Control unit shall "lock-in", permitting clearance by manual reset only.

2) System alarm visual indicators shall be energized (synchronous flashing mode).

3) Alarm relay contacts shall change state (applicable modules).

4) Silenceable and non-silenceable alarm outputs shall be energized (sounding audible devices).

5) Supervised annunciator circuitry shall receive a high-going, current-limited alarm signal.

6) Evacuation message shall be sounded in all areas, with selective paging to each individual floor (zone).

7) System alarm initiating device(s) parameters (address, type, status, applicable Owner designated message) shall be displayed.

8) All doors normally held open by door control devices shall release after a programmable time delay.

9) A supervised signal to notify an approved central station shall be activated.

10) The mechanical controls shall activate the air handling systems as indicated on the drawings and upon reset request shall sequentially start-up air handling units to minimize power demand.

11) The alarm activation of any elevator lobby smoke detector shall, in addition to the operations listed above, cause the elevator cabs to be recalled according to the following sequence:

a) If the alarmed detector is on any floor other than the main level of egress, the elevator cabs shall be recalled to the main level of egress.

b) If the alarmed detector is on the main egress level, the elevator cabs shall be recalled to the predetermined alternate recall level as determined by local authority having jurisdiction.

12) Engaging momentary "Acknowledge" switch shall de-energize audible devices and cause the system alarm visual indicators to light steadily.

2. Subsequent alarm condition ("Acknowledge" engaged):

a. The silenceable output alarm terminal shall receive a renewed, high-going signal (re-energizing audible devices).

b. System alarm visual indicators shall renew their flashing mode.

1) Trouble condition:

c. In response to a trouble condition:

1) System trouble visual and audible (buzzer) indicators shall be energized (flashing mode).

2) Trouble relay contacts shall change state (applicable modules).

3) Supervised annunciator circuitry shall receive a high-going, current-limited trouble signal.

4) Remote trouble and silence stations shall receive a trouble signal.

5) System trouble initiating parameters shall be displayed.

d. Trouble conditions shall include:

1) Circuit "open" for:

a) Alarm relay coil.

b) Audible signal.

c) Initiating device.

d) Module placement.

e) Municipal tie.

f) Remote station.

2) Auxiliary power output fuse open.

3) Audible signal circuit short.

4) Circuit ground fault for:

a) Audible signal.

b) DC power.

c) Initiating device.

5) Intelligent/analog initiating device "drift" beyond alarm threshold.

6) Failure of:

a) AC power input.

b) Battery/charger transfer.

c) Regulated, 12V DC, logic power.

7) Momentary contact switch not fully closed.

8) Printer out of paper.

9) Remote station alarm silence switch not in normal position under non-alarm conditions.

1. "Sprinkler Valve Tamper Switch" operation causes or initiates the following:

a. Initiates a supervisory audible and visible indication at the FACP and a common system trouble indication at the graphic annunciators.

b. Initiates transmission of trouble signal to facility monitoring system.

3.03 INSTALLATION

A. General:

1. The Contractor shall possess a New York State license for the installation and testing of alarm systems.

B. Wiring:

1. General:

b. It is the intent of this specification that all associated wiring shall be installed in compliance with power-limited fire protective signaling circuits in strict accordance with the National Electrical Code and shall be the responsibility of this Contractor, except that all final connections at the system control panels (in a neatly dressed fashion) shall be executed by an authorized technician who shall check for proper circuit resistance and shorts to ground prior to consummating the terminations.

c. All wiring shall be twisted, low voltage, shielded plenum cable; color code shall be maintained throughout.

d. Exposed wiring and/or concealed wiring (except) that above accessible suspended ceiling systems) shall be installed in dedicated electrical metallic tubing with set-screw and compression type couplings and connectors for interior dry locations and interior wet locations or exterior locations, respectively.

e. All junction boxes associated with the fire alarm system shall be sprayed RED and labeled "FIRE ALARM".

f. Indicating appliance circuits and initiating device circuits shall be run in separate conduit system.

g. Signaling Line Circuits – Network Data: Twisted pair, not less than No. 18 AWG or as recommended by the manufacturer.

h. Signaling Line Circuits – Intelligent Loop: Non-Twisted pair, not less than No. 16 AWG or as recommended by the manufacturer.

1) Circuit Integrity Cable: Provide as required to meet NFPA or Local Code requirements.

2) CI Cable shall meet article 760, power limited fire alarm service.

i. Notification Appliance Circuits:

1) Audio: Twisted pair, not less than No. 16 AWG or as recommended by the manufacturer.

2) Visual: Non-Twisted pair, not less than No. 12 AWG or as recommended by the manufacturer.

j. 120 VAC circuits:

1) Minimum 10 AWG for panel power circuits. Minimum 12 AWG for all other circuits.

2) Sharing of neutrals is prohibited. Each circuit shall have its own dedicated neutral conductor.

k. Fiber Optic Cable:

1) Only glass filament cable permitted. Plastic filament fiber optic cables are not acceptable.

2) 62.5/125 micron fiber optic cables.

3) ST connectors used at all equipment terminations.

3.04 PROGRAMMING

A. General:

1. Programming shall be executed by an authorized technician.

2. Update software to latest available version at project completion and install and program software upgrades that become available at any time during guarantee period.

B. Operation:

1. Expandable and reprogrammable at any time up to system's maximum capacity.

2. Operating system shall be field programmable for program changes and shall not require any factory modifications.

3. Each addressable device shall be uniquely identified by an address code (Owner selected) entered at time of installation.

3.05 SUPERVISION AND TESTING

A. General:

1. Supervision and testing shall be executed by an authorized technician.

B. Supervision:

1. Provide "on-site" observation throughout the system construction period, lending all guidance necessary to insure proper installation.

2. Perform the prescribed "systems demonstration" and "instruction".

3. Provide as-built drawings.

C. Testing:

1. Dedicated function keys shall be programmed to permit testing:

a. Municipal tie without energizing signaling devices.

b. Strobes without energizing audible signals.

2. Record:

a. Date.

b. Technician's name and certificate number.

c. Listing of installed equipment, including location (address) and model and serial numbers for all initiating devices.

d. Statement that the system is properly installed.

3. Measure (with the associated HVAC system operational) and record:

a. Ionization and photoelectric smoke detectors sensitivity.

b. Thermal and flame detectors response time.

4. Speaker Intelligibility:

a. The speakers and sound levels shall be tested by the contractor to insure that the system meets the intelligibility standards for Fire Alarm and Mass Notification Systems. The sound from the speakers shall be a minimum of 15dB above the ambient noise levels throughout the facility. Testing shall be done with a Sound Level Meter or an Audio Analyzer. Contractor shall record the ambient and alarm sound levels as part of the "System Certification Test Report". Also, the contractor shall test the intelligibility of the speakers throughout the facility to insure that the intelligibility meets the requirements of the UFC 4-021-01. The test performs with a Audio Intelligibility Analyzer such as a Goldline DSP-30B or the Quest Technologies Sound Pro SE/DL. The sound levels shall be tested at ear level throughout the facility and the results included in the "System Certification Test Report". The minimum intelligibility score shall be a .8 CIS (Common Intelligibility Score) or .7 STI (Speech Transmission Index). The mean value of at least three readings shall be used to compute the intelligibility score at each test location.

b. In areas that fail to meet the Intelligibility requirements, the contractor will add a sufficient number of speakers and retest the area until the intelligibility requirements are satisfied. In high ambient noise areas or in areas where it is deemed impractical to meet the intelligibility levels, the AHJ has the authority to waive the testing in this area.

c. Areas of the building where occupants are not expected to be normally present are permitted to have a CIS score less than 0.8 if personnel can determine that a voice signal is being broadcast and they must walk no more than 15 m (50 ft) to a location with a CIS score of at least 0.8.

3.06 INSTRUCTION

A. Provide thorough demonstrative instruction (2, 4-hour sessions) via factory trained technicians (representatives of the manufacturer's authorized distributor); secure the Contracting Officer's written acknowledgement and submit to the Engineer.

3.07 COMPUTER SOFTWARE

A. Provide standalone combination mass notification/emergency communication and addressable fire alarm and detection systems testing hardware and software to the Contracting Officer at the completion of the project.

3.08 TRAINING

A. Provide complete certified factory technical training for a minimum of two of the Owners select representatives. The Owners representatives shall, upon completion of the above training, be factory qualified to perform complete programming, maintenance and repair of the fire alarm system. The contractor shall assume the responsibility to coordinate with the Contracting Officer, the location and time required for the above certified factory technical training.

END OF SECTION

SECTION 26 67 40

SECURITY SYSTEMS

PART 1 – GENERAL

1.01 REQUIREMENTS

A. Furnish and install IP based security systems in accordance with the parameters shown on the drawings and herein specified.

B. Systems shall be the modular, microprocessor based type; networked for single point programming and information sharing; Underwriters Laboratories listed, Federal Communications Commission compliant; complete with control panel, addressable expansion module, programmable LED keypad, magnetic door locks, intrusion alarms, motion sensors, sirens, horns, ancillary components and cable.

C. Refer to Section 16010, General Provisions, for requirements relative to submittals, accessories and components, installation, removals, protection, maintenance manual, systems demonstration and instruction; additionally, Section 16111, Conduit Systems, and Section 266748 Communications Cable - Copper shall apply.

1.03 SOURCE AND SERVICE

A. Source:

1. Basic systems components and associated accessories shall be furnished by a single manufacturer through a factory authorized equipment distributor.

B. Service:

1. Systems service shall be available from the manufacturer's authorized distributor 24 hours of every day via qualified factory trained technicians.

1.04 GUARANTEE

A. The system shall be guaranteed to be free from defects in materials and workmanship for a period of one year from the date of final acceptance by the Owner, during which time all above mentioned defects shall be corrected and all services incidental to proper performance shall be provided free of charge.

1.05 FABRICATION DRAWINGS, MATERIAL LISTS AND EQUIPMENT SUBMITTALS

A. Descriptive literature for system components.

B. Material lists for system distribution (wire, cables, boxes, support, etc.).

C. One-line diagram, including component interface.

D. Wiring diagrams for component connections.

E. Description of operation.

PART 2 – PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Genetec, Bosch, Northern Computers, Ademco, Notifier or approved equal.

PART 3 – EXECUTION

3.01 SYSTEM ARRANGEMENT

A. System arrangement shall be consistent with the component locations and riser diagram shown on the drawings.

B. Precise as-built mark-ups (illustrating actual field wiring arrangements and equipment configurations) shall be submitted to the Engineer.

3.02 INSTALLATION

A. Wiring:

1. It is the intent of this specification that all associated wiring (per manufacturer's requirements) shall be installed in compliance with power-limited fire protective signaling circuits in strict accordance with the National Electrical Code and shall be the responsibility of this Contractor, except that all final connections at the system control panels (in a neatly dressed fashion) shall be executed by an authorized technician who shall check for proper circuit resistance and shorts to ground prior to consummating the terminations.

2. All wiring shall be shielded (as required) plenum cable.

3. Exposed wiring and/or concealed wiring (except that above accessible suspended ceiling systems) shall be installed in dedicated electrical metallic tubing with set-screw and compression type couplings and connectors for interior dry locations and interior wet locations or exterior locations, respectively.

3.03 PROGRAMMING

A. General:

1. Programming shall be executed by an authorized technician.

B. Operation:

1. Expandable and reprogrammable at any time up to system's maximum capacity.

2. Operating system shall be field programmable for program changes and shall not require any factory modifications.

3. Each component shall be uniquely identified by an address code (Owner selected) entered at time of installation.

3.04 SUPERVISION

A. General:

1. Supervision and testing shall be executed by an authorized technician.

B. Supervision:

1. Provide on-site observation throughout the system construction period, lending all guidance necessary to insure a proper installation.

2. Perform the prescribed "systems demonstration" and "instruction".

3. Provide as-built drawings.

3.05 INSTRUCTION

A. Provide thorough demonstrative instruction (2, 4-hour sessions) via factory trained technicians (representatives of the manufacturer's authorized distributor), secure the Owner's written acknowledgement and submit to the Engineer.

END OF SECTION

SECTION 26 67 41

ACCESS CONTROL SYSTEM

PART 1 – GENERAL

1.01 REQUIREMENTS

A. Furnish and install access control systems in accordance with the parameters shown on the drawings and herein specified.

B. Systems shall be the modular, microprocessor based type; networked for single point programming and information sharing; Underwriters Laboratories listed, National Electrical Code and National Fire Protection Association, Federal Communications Commission compliant; complete with control panel, controllers, credential readers, credentials, ancillary components, cable and software.

C. Refer to Section 16010, General Provisions, for requirements relative to submittals, accessories and components, installation, removals, protection, maintenance manual, systems demonstration and instruction; additionally, Section 16111, Conduit Systems, shall apply.

1.02 SOURCE AND SERVICE

A. Source:

1. Basic systems components and associated accessories shall be furnished by a single manufacturer through a factory authorized equipment distributor.

B. Service:

1. Systems service shall be available from the manufacturer's authorized distributor 24 hours of every day via qualified factory trained technicians.

1.03 GUARANTEE

A. The system shall be guaranteed to be free from defects in materials and workmanship for a period of two years from the date of final acceptance by the Owner, during which time all above mentioned defects shall be corrected and all services incidental to proper performance shall be provided free of charge.

1.04 FABRICATION DRAWINGS, MATERIAL LISTS AND EQUIPMENT SUBMITTALS

A. Descriptive literature for system components.

B. Material lists for system distribution (wire, cables, boxes, support, etc.).

C. One-line diagram, including component interface.

D. Wiring diagrams for component connections.

E. Description of operation.

PART 2 – PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Galaxy Control Systems or approved equal.

2.02 SUMMARY (SYSTEM DESCRIPTION)

A. Software Application: System Galaxy Version 8.X or higher, communicating with 600 series Access Control Panels or ACPs.

B. Access Control: to building and selected areas using key fob, proximity cards, magnetic swipe, barcode, or biometric identifiers .

1. Select Exterior Doors: Control access into building at locations as shown on drawings.

2. Select Interior Building Areas: Control access into areas as shown on drawings.

C. Restrict Access: of individual credential-holders by time of day, day of week/month/year and specific points of entry via user-configurable software.

D. Unlock Doors: to building and selected areas automatically, where shown on drawings, for a scheduled period of time throughout the day allowing free access and egress without the use of a card and avoiding the generation of an alarm condition on the access control system. The system GUI computer operator shall be able to unlock doors from the computer system.

E. Monitor Points: in building and selected areas as shown on drawings, that may provide unauthorized access or egress and may be a point for forced entry. The system shall report changes in status for all monitored points indicating the specific location so the operator can respond appropriately.

1. Selected Exterior Perimeter and Internal Points: Provide four-state supervised inputs to system for monitoring the status of doors.

2. Communicate with Intrusion Detection Devices under provisions in this specification.

F. Video Monitoring: of doors and alarms when access is requested or a door is opened. This is provided by connection between the Access Control System, Video Surveillance System over an IP or 232 Interface

1. IP interface shall be available for the Discovery DVR video line or approved alternates

2. 232 Interface shall be available for approved analogue Matrix switchers.

G. System Interface: Shall provide a real-time display of all alarms and system events, archive all events in a history file to a relational database and serve as the instrument through which all system programming is accomplished. Computer/Workstation shall be configured for the intended system function by loading the appropriate services and operating system software.

1. Access Control System Computer shall be installed as field directed and shall run the DB Writer service for interfacing with the system database, a SG Comm service for polling system panels and communicating with the database service, a SG Client Gateway service for interfacing system activity and database administration with all System Galaxy Clients on the PC/Network. The system server shall have a Windows 2000, XP, or 2003 operating system for the access control software installed.

H. Central Database Server: The DB Writer service shall provide a connection between the Central Database Server all Access Control Panels (ACP's). The connection to the ACP's will be over a Local Area Network (LAN) connection. The central system will provide real-time transactional storage of all system events, archive time configured events into a separate Archive Database serve as the instrument through which all system programming is stored.

1. The Database Server shall be Microsoft SQL 2000 or 2005

I. Access Control Panels shall be installed in the equipment rooms as indicated on the Contract Documents, communicating to the Central Server over a local LAN connection. The ACP's shall connect to all reader and alarming devices. The system shall provide:

1. Access Control: to building and selected areas using proximity cards, magnetic swipe, barcode and biometric scanners.

a. Selected Exterior Doors: Control access into building at locations as shown on drawings.

b. Selected Interior Building Areas: Control access into areas as shown on drawings.

J. Provide graphical display of building maps with dynamic display of door status and alarms on all access control workstations.

K. Provide report generation for all alarm signals.

2.03 GENERALIZED DESCRIPTION OF WORK

A. Provide Access Control System including network computers, controllers, credential readers, credentials and badging station.

B. Provide detection devices such as motion detectors.

C. Connect electric strikes and monitor status of door controls as outlined on Contract Drawings.

D. Connect magnetic door switches and monitor status of the selected doors as outlined on Contract Drawings.

E. Provide request for egress Passive Infrared Detectors (PIR) and pushbuttons.

F. Provide all required power supplies. Coordinate with the Electrical Contractor.

G. Provide all cabling connections required.

H. Provide all specialty conduit requirements. Coordinate with the Electrical Contractor.

I. Coordinate all door hardware with door supplier.

2.04 OVERVIEW

A. The devices described herein are intended to provide a reference for the Card Access System and are to be provided as described in the Contract Documents.

B. Certain devices described may not be applicable to all systems. All devices required to complete the installation may not be described but shall be provided as if specifically called for within the Specification to provide a complete working system.

C. The system shall be of an open architecture design and shall support industry standard databases such as Microsoft SQL Server 2000/2005, MSDE or SQL Server 2005 Express.

D. A system server for enterprise wide database services, system programming, system monitoring, administrative services, report and proximity card generation.

E. A workstation computer shall provide interfacing and control of the local, site specific, Access/Security System.

F. The System shall be of a distributed database design, using intelligent microprocessor panels, to make smart decisions at the door.

G. The system shall be capable of utilizing a true client server network configured to support the system database service, all panel services and user interfaces optimizing the users' options for system programming, event monitoring and record keeping.

H. The database service shall be ODBC compliant allowing the system to access an existing compatible ODBC compliant database as the system data source. A single system database shall maintain both credential-holder's records as well as access system information and programming parameters.

2.05 MANUFACTURERS

A. The Access Control System shall be System Galaxy provided by Galaxy Control Systems or approved equal.

B. Key fobs and card readers, long range proximity card reader shall be manufactured by HID Corporation or approved equal.

2.06 ACCESS CONTROL SYSTEM WORKSTATION

A. Primary Security Station: Provide computer operating latest generation Microsoft Server operating system supported by manufacturer, with 100 GB hard drive, internal-drive backup, 1Gig RAM, 128 MB-Video RAM, CD-RW Drive, 17" SVGA Monitor, Optical Mouse, Keyboard, two (2) serial comm. ports, One (1) parallel comm. Port, two (2) USB 2.0 ports, 10/100 Mbps fiber optic NIC Ethernet card, HP Laserjet report printer, MagiCard PVC card printer, Integral Flashbus MV (TWAIN) capture card, camera, tripod and backdrop.

B. Contractor to provide additional ports as required to meet each manufacturer's interface requirements and to provide a fully integrated system. Refer to 13700 and contract drawings for integration requirements.

C. Provide complete programming as required for:

1. Graphical User Interface (GUI) including graphic maps/floor plans with all devices shown. Provide all alarm, trouble, access, signaling, and GUI operator interfacing through the graphic maps in the system software.

2. Database management including credential reader, fingerprint scan data, credential-holder data, access groups, time zones, and input/output devices.

3. Password protection and operator levels.

4. System Management Reports. Provide and interface report printer as specified in this Section.

5. Alarm notification, acknowledgement and actions taken.

6. Special programming as required by Owner. Contractor shall modify GUI screens and/or software operations to Owner's satisfaction at commissioning.
7. Interface with Video Surveillance System for integrated GUI screens and on screen camera call-up and control.

8. System Management Reports.

2.07 SOFTWARE

A. Software Capacities

1. System software and language development software shall be existing, industry accepted, and of a type widely used in commercial systems. Operating system shall be multi-user/ multi-tasking capable of operating in a non-proprietary CPU. The application software, substantially as offered, shall be written in a high level, industry standard programming language. The system shall be modular in nature, allowing the system capacities to be easily expanded without requiring major changes to the system operation and maintaining all defined system data as well as historical information.

2. All System functions shall be accessible via point and click mouse control. Systems requiring command string control or complex syntax are not acceptable. The system software shall include the following features and be configurable for a minimum:

50,000/120,000 option credential capacity (at the ACP)

b. Unlimited credential records (at the Database)

c. 256 user-definable time schedules per loop/site

d. Unlimited programmable holidays.

e. 9 Unique holiday types

f. 1500 Access Groups

g. 10,000 Event log-buffer (at the ACP) for disconnect transactional storage

h. Customizable Operator Privileges – limit site, commands, and viewing rights

i. Primary and Auxiliary door outputs for each defined reader

j. Dedicated Door Contact and Request to Exit (REX) inputs for each defined reader

k. Global Anti-Passback

l. Door Groups

m. Door Interlocking (Mantrap)

n. Remote Door Control

o. Scheduled Unlock, with Valid Unlock on "day of" option

p. Schedulable PIN Required option

q. Automatic Active/Expire Dates for Credentials

r. Maximum "number of uses" settings per credential

s. Americans with Disabilities Act (ADA) compliance in door and access operation

t. Serial or Ethernet interface with CCTV matrix switchers or DVR units

u. Input/Output linking with Boolean (AND/OR) logic

v. Routable Alarm events

w. User-selectable LED behavior

x. Traced Cards

y. Badge Print Tracking

z. Setup Wizards

aa. Online Help

bb. Dynamic Device Status Screen

cc. Loop Diagnostic Software Tools

dd. 21 User Definable Fields – plain text and user-populated select lists

ee. User-Select Mandatory Fields

ff. Extensive Reporting using an Activity Matrix

gg. Embedded Crystal Report™ Templates

hh. ODBC Data Import/Export

ii. Event Log Output

jj. Data Audit Trail

kk. Video Verification

B. Software Operation

1. The system shall provide a top down configuration methodology. Top down programming shall allow the system operator to configure the system software and hardware configurations in a logical flowing method. The system should allow the operator to start at the highest configuration level of the system and then move down through the lower configuration levels without having to move back and forth between a variety of menus.

2. The system shall utilize dynamic icons. The dynamic icons shall change appearance, in both color and icon display based upon the status of the associated object. This appearance change shall occur in real time and shall not require the system operator to perform a screen refresh or exit the current screen.

3. Dynamic icons shall be provided to represent:

a. Door lock control.

b. Cameras and domes.

c. Alarm input.

d. Output control relay.

e. Manual operator actions.

4. For intelligent field panels hard wired to the host computer, the dynamic icons shall reflect the true state of the device represented by the icon. If an operator issues a command to unlock a door, and the field panel which controls that door is not in communication with the host computer, the icon shall not change state or appearance.

5. Where certain data fields within data screens may contain the same information, the system shall provide the ability to define default settings for these data entry fields including "drop-down" select lists. The operator shall be able to change the default setting without impacting objects that have already been defined.

6. The Security Management Control System shall utilize a database engine which is Open Database Connectivity (ODBC) compliant. This database engine shall be compatible with 32 bit ODBC drivers. The system shall allow the ability to perform ODBC writes to the system database to import personnel data directly into that database.

7. It shall be possible to use third party report tools, such as Crystal Reports to generate reports not already provided by the Security Management Control Systems, such as statistical or graphical reports of system activity.

8. Database level Username and Password protection shall be provided for ODBC users. ODBC users will be required to supply a Username and Password when they connect to the SMCS database. Usernames and passwords shall be configured via the user configuration functionality currently available in the Administration utility.

9. The system shall support the date being formatted in DD/MM/YY or MM/DD/YY, depending upon local date formatting.

C. Hardware Definitions

1. The System software shall allow for the configuration and programming of the access control modules through the use of simple menu commands. The menu commands may be executed by keystroke and mouse point/ click control.

2. The allocation of memory, between cardholder records and historical event buffering, within each access control modules shall be separated. Transactions shall not overwrite programmed data but rather maintain an allocated 10,000 event buffer.

3. The system software shall allow the configuration for up to 255 Clusters each maintaining up to 254 intelligent field panels with ability to configure and maintain all Clusters simultaneously.

4. The system software shall download/upload information to/from the System Server automatically while the controller is in communication with the host CPU.

5. The system must maintain hot-swappable components for easy repair replace procedures. These components must include Central Processor, Digital Input/Output board, and Dual-Port Interfaces.

6. System expansion must be modular. Additional modules required for incremental system expansion shall be available in two (2), eight (8) and sixteen (16) door configurations to allow for maximum installation flexibility and optimum cost.

D. Time Specifications

1. The system software shall allow unlimited holidays. Holidays shall be considered as additional days of the week and shall have different user programmable parameters from the normal designations for that day. The system shall provide the ability to designate nine (9) types of holidays, allowing certain segments of the system to be under holiday control, while other segments of the system are under normal time controls. The system shall allow the holiday to be addressed within the system by the user defined name assigned to that holiday, i.e. New Year's Day, can be addressed as New Year's Day.

2. Each time specification shall be comprised of user defined time segments. Each time segment shall be day(s) of the week, to include holidays, and a starting time and an ending time. The system shall provide point, click, and drag functionality as well as copying tools, for easy system configuration.

E. Time Zone Management

1. The system shall allow the end user to configure the host server, operator workstations, and field hardware devices, such as access control panels, clearances, elevators, some groups and reports to be in different time zones. A time zone is a "time zone" such as Eastern Standard Time and does not indicate a time specification.

2. The system shall support all time zones supported by the operating system. When defining a time zone to be used by the system, the system shall be provided with a drop down listing of all time zones defined by the operating system. The operator shall be able to select the appropriate time zone from this listing.

3. The activation date/time and the host-received date/time of activity shall display with respect to the time zone where the operator workstation is located.

4. For each specified Time Zone, the system shall supply a non-editable field indicating whether or not the specified Time Zone adjusts for daylight savings time.

F. Alarm Events

1. Events shall be used throughout the system to allow the system to react to system activity. For instance an event may be activated based upon an alarm point going into an alarm state. Events shall merge the links to actions, annunciation, communications port failure and timed activation capabilities into one component. An event shall perform multiple functions determined by the actions the user associates with it.

2. The system shall provide 10,000 priority levels. The system shall allow the operator to choose an individual priority.

3. The system shall allow an event to be configured to:

a. Require or not require operator acknowledgment.

b. Not be cleared unless a log message is entered by the system operator responding to the event.

c. Display or not display the event activation.

d. Require the point(s) causing the event activation to reset before the operator may acknowledge the event.

e. Display a user defined text message (80 characters) upon event activation.

f. Display a user defined text message (80 characters) when event is deactivated.

g. Be associated to a map so the map opens automatically on the Monitoring Station when that event activates.

h. Configure an event so that if it activates and is unacknowledged for a specified period of time, a second event is activated

i. Allow the user to associate and audio wave file with an event.

4. The system shall allow the user to define event instructions that shall be displayed to the system operator when responding to an event activation. There shall be no limit to the amount of text that may be included in the event instructions.

5. The system shall allow an event (input, valid access, etc.) or trigger to be configured to cause other system actions to occur. These system actions shall include:

a. Lock/Unlock door(s) and/or door group(s)

b. Momentary unlock of door(s) and/or door group(s)

c. Secure door(s) and/or door group(s)

d. Incremental counting results

e. Decrementing counting results

f. Limit counting results

g. Alarm/disarm event(s) and/or I/O group(s)

h. Alarm/disarm alarm input(s) and/or input group(s)

i. Activate/deactivate output control relay(s) and/or output control relay group(s)

j. Momentary activate output control relay(s) and/or output control relay group(s)

k. Activate CCTV action

l. Automatic display of an associated map on a Monitoring Station

m. I/O Group set triggering

n. Activate Discovery DVR (or approved equal) action

o. Activate Discovery DVR (or approved equal) pop-up

p. Activate PC audible alert

6. The system shall control, on an action by action basis, dynamic access, input and output changes. Thus when initiating a Crisis Mode on a site, inputs and

outputs can react accordingly and access privileges (system-wide) will be modified to an alternate setting.

7. It shall be possible to control via a user defined time schedule the period during which an event shall be armed and therefore capable of being activated by other system actions.

8. The system shall allow a graphic map display to be linked to an event. This graphic map shall be available to the system operator to display when responding to the event activation. Graphical maps shall be centralized in the network on a shared disk and be available for display on all operator workstations.

9. The system shall allow for the automatic display of a graphic map-linked to an event. This graphic map shall be available to the system operator to display when responding to the event activation. At the Monitoring Station, when an event is configured to automatically display a map, a map will pop up each time the event is activated. The map will disappear when the event is acknowledged. Graphical maps shall be centralized in the network on a shared disk and be available for display on all operator workstations.

G. Door Definitions

1. Each door shall be addressed within the system by a unique hard-coded name relevant to the location within the controller position and a "user-friendly" definable name for easy recognition

2. The system shall allow a reader to be configured to operate using the following functions:

   a. Readers shall read cards while the door is in the open position

   b. Door lock shall automatically lock upon the door being opened

   c. Door lock may be configured to lock upon the door being closed

   d. Separate timers for the operation of the door lock and the software shunting of the door position status alarm point. The shunting of the door contact following the presentation of a valid access card or activation of the request to exit device shall be accomplished by software control

   e. The system shall allow each door to be configured to cause a variety of events to occur based upon activity at that door

   f. Ingress areas shall be disarmed based on Valid Access at the door by a software mechanism without the use of an auxiliary relay

   g. Reader shall allow for association with Video Verification module

   h. Reader shall allow for automatic schedule based on time schedules and a provision for refraining from unlock based on no Valid Card for that day (i.e. Snow Day rule)

   i. Auxiliary relay may be associated to react based on triggerable door events

j. Alarm associations may be made based on the following door actions:

Door Forced Open

Door Open too long

Invalid Attempt

Passback Violation

3. The system shall allow each reader to be configured to cause an output to activate based on activity at that door.

4. The system shall allow for a time specification to be configured and associated to a door that will require a valid PIN entry for access during the specified time spec after a card access (unless a manual action or event has disabled PIN).

5. The system shall allow reports to be generated directly from the reader properties' screen without having to search sub-set report menus. The system shall also allow for a right-click function to run reports from a Hardware Tree or event transaction of the door.

H. Input/Alarm Configuration

1. Each alarm point shall be addressed within the system by a unique hard-coded name relevant to the location within the controller position and a "user-friendly" definable name for easy recognition

2. The system shall accept as an alarm input: supervised alarm inputs, unsupervised alarm inputs and dedicated alarm points such as device tamper alarms and controller AC power failure.

3. The system shall have the ability of monitoring input points in eight (8) states for triggering conditions:

a. Active: Monitored activation of input

b. Alarm: Monitored activation of input while in an armed state

c. Armed: Device placed in armed state either by alarm input or arming schedule

d. Disarmed: Device placed in disarmed state either by event trigger or disarm schedule

e. Nothing: No triggering conditions for set input

f. On: Monitored input that has been activated but not armed

g. Trouble: Monitored input maintaining supervision that cannot validate the correct resistance value (due to cut or short)

h. Trouble or Alarm: Monitored input is that maintains either a trouble or alarm condition

4. Report View: The system shall allow reports to be generated directly from the input properties' screen without having to search sub-set report menus. The system shall also allow for a right-click function to run reports from a Hardware Tree or event transaction of the input

I. Output Control Relay

1. Each output point shall be addressed within the system by a unique hard-coded name relevant to the location within the controller position and a "user-friendly" definable name for easy recognition

2. Output control relays shall be defined as maintained or momentary. Maintained output control relays shall be configured to be activated/deactivated based upon a user defined time schedule, linked to a system event or operator command. Momentary output control relays shall have a user-defined pulse time (defined in 1 second increments). It shall be possible to use the momentary output control relays for the momentary control of devices other than door locking hardware. Output control shall also have the inherent ability to utilize Boolean logic including ability to act upon logic, limiting, and counting triggers

3. There shall be the ability to trigger software-based outputs that can later be associated as future triggering inputs for advanced logical schemas

4. The system shall allow reports to be generated directly from the output properties' screen without having to search sub-set report menus. The system shall also allow for a right-click function to run reports from a Hardware Tree or event transaction of the input

J. Operators/Users

1. The system software shall be capable of identifying an unlimited number of system operators. Passwords shall be hidden from the Software GUI

2. Each operator authorized to operate any portion of the system shall be addressed within the system by a unique user defined name. The operator name will be used throughout the system to identify commands and functions that the operator has executed as part of an audit trail.

3. All commands issued by a system operator while monitoring system activity including locking/unlocking doors, event acknowledgment, etc. shall be stored in the historical archive for later recall. The report command shall include the operator name, time and date the command was issued and the command issued by the operator.

4. The system shall allow reports to be generated directly from the operator properties' screen without having to search sub-set report menus.

K. Operator Privileges

1. Each operator shall be assigned an operator privilege matrix. Operator privilege matrices define the individual commands within the system which the operator is authorized to execute.

2. When selecting the Master Operator privilege option within the system, the operator shall be given access to assign/modify the Operator privileges along with select Workstation options.

3. Each operator may be configured to have access to perform online (software generated) actions with Doors/Readers, Inputs, Outputs, I/O Groups, Elevators, and Card Commands to include:

   a. Unlock: Unlocks the door/reader until a subsequent command, trigger, or schedule relocks the device

   b. Lock: Locks the door/reader until a subsequent command, trigger, valid access, or schedule unlocks the device

   c. Pulse: Performs a momentary (pre-configured duration) unlock of the door/reader

   d. Enable (Reader): Enables the reader after a disable command

   e. Disable (Reader): Disables the reader (typically for service operation)

   f. Relay 2 On (Reader): Fires (Turns On) the auxiliary relay of the door/reader port

   g. Relay 2 Off (Reader): Releases (Turns Off) the auxiliary relay of the door/reader port

   h. Shunt (Input): Masks reporting of the input device until a subsequent command, trigger or schedule unshunts the device

   i. Unshunt (Input): Enables reporting of the input device until a subsequent command, trigger or schedule shunts the device

   j. Service Mode (Input): Disables Input actions for service operations

   k. Restore (Input): Enables input actions after Service Mode is selected

   l. Arm (Input): Manually places input into an armed state until a subsequent command, trigger, valid access or schedule disarms the device

   m. Disarm (Input): Manually places input into a disarmed state until a subsequent command, trigger, or schedule arms the device

L. Credential Record Definitions

1. The system shall allow a privileged system operator to specify field name, field type, field restrictions and whether or not a field is mandatory and/or selectable. The system shall provide the operator the ability to view the credential record layout, including the new labels, before the changes are put into use.

2. Personnel records shall be constructed to contain personnel data and user defined fields. The personnel data shall consist of a minimum of the following:

a. Credential-holder name.

b. Encoded card number.

c. Employee ID number (system defined, Primary Key).

d. Last Access

e. Card Technology

f. Personal Identification Number (PIN) code.

g. Facility number.

h. Activation date and time.

i. Expiration date and time.

j. 21 user defined fields.

k. Department

l. Card Role (Access Card, Alarm Card)

m. PIN Exempt

n. Passback Exempt

o. Number of Uses

p. Stored image of the person.

q. Stored signature of the person.

r. Store biometric fingerprint identification of the person.

s. Identification badge layout assigned to the person.

t. ate last identification badge was printed.

3. The system software shall provide a means whereby the master operator may define certain user-defined fields in the personnel record as being mandatory. Personnel performing data entry on the card holder record shall be required by the system to enter information in all field marked by the system administrator as mandatory**.**

4. The system software shall provide a means whereby the system administrator may define certain user-defined fields in the personnel record as choice list fields. The system administrator shall be able to define the choice list and the values to be included in the choice list. The operator, when performing data entry, shall be able to choose one of the values defined in the choice list.

5. The system software shall provide means for bulk loading and bulk editing of card records through the use of a data file generated from another source. The external file shall be an ODBC file source. The system shall also provide the ability to generate the same format file of existing card records, allowing

the information in the system to be exported to other computers and applications. The system shall allow the user to select the card records that shall be included in the export file.

6. The system shall provide a card holder selection list, allowing the system operator to choose individual cardholder records from the selection list. The selection list shall provide a quick sorting display of all cardholder records and advanced SQL query tools including an SQL query builder.

7. The system shall allow reports to be generated directly from the cardholder properties' screen without having to search sub-set report menus. The system shall also allow for a right-click function to run reports from the event transaction of a cardholder

M. Automated Personnel Data Import

1. The system shall provide a means to import personnel information from an external ODBC database other than import from a flat file. Additionally, the import shall execute in the background periodically to avoid the need to run the Administration application each time personnel data is to be imported. The import procedure shall also perform the necessary validity checking to prevent corruption of the system personnel table.

2. Each Automated import shall be user defined name. The profile shall be saved with an import schema on the hard drive of the system workstation.

3. The system shall allow the user to specify how the records are retrieved from the external database during the automated process and the amount of detail the import activity log will display after an automated import is run.

4. The system shall allow the user to select from a list of external databases. It shall allow the user to enter a user ID and password if one is required by the external database.

N. Reports

1. All programmed and transactional history is automatically stored to the database for later recall. Information written to the database shall be immediately available for report generation.

2. The system software shall be able to generate reports without affecting the real-time operation of the system.

3. Reports shall be generated from the database and generated to the operator's screen, hard disk, floppy disk or printer(s).

4. The database shall be structured such that the operator shall determine the search parameters based on variables available on the individual report matrix. Systems requiring the user to type complicated search strings are not acceptable.

5. Programmed data reports shall be available for Database Configuration and Historical Activity.

6. The system shall be capable of producing reports of database configuration information. These database configuration reports shall include hardware and software configuration, group, time zone, activity and audit log reports.

7. Depending upon the type of report being generated by the system operator, the system shall provide a listing of previously defined reports. The operator shall be able to pick an existing report, modify an existing report or generate a new report.

8. The system shall contain pre-defined reports that shall report the database configuration for area, holiday, time specifications, time zones, elevator, event, all groups, control outputs and authorized card holders.

O. The "Who's-In" report shall provide a listing of all personnel that the system has determined to be in a user-specified area. The "Who's-In" report can be used in emergency evacuation situations, to determine if personnel are in the building, and where they are in the building. The "Who's-In" report can be initiated by an event or run as a report by a system operator that can be automatically refreshed on the screen to keep current as personnel exit the area.

P. The system shall provide an audit trail function that is intended to record all permanent changes in data configured by system operators. The audit trail shall record permanent changes made to the configuration data base by manual operator data entry.

Q. Help Screens

1. The system software shall have on line help available at any point requiring operator input. The help screen shall be accessible from a pull down menu. This help screen shall contain information that shall allow the operator to enter correct data without consulting a manual.

R. Activity Monitoring

1. General Display Features

a. The activity monitoring screen shall include the event, date/ time display, user, active events, events require acknowledgement and loop/site information.

2. Event audible annunciation refers to the beeping behavior of the operator workstation when there is at least one active and unacknowledged event. The operator workstation shall beep continuously as long as there is at least one active and unacknowledged event. The beeping shall continue until the operator acknowledges all such events or uses the "Silence" button to silence all audible for all such events.

3. Pop-Up Events

a. When an event needing acknowledgment becomes active, the alarm monitoring screen shall be displayed on all operator workstations currently logged in designated to receive such a priority alarm

b. If the System Galaxy program has been shrunk to an icon, the alarm monitoring program shall pop open and be displayed on the operator workstation as the top-most window.

c. If the event monitoring program is behind other tabs, the alarm monitoring program shall be pop forward and displayed on the operator workstation as the top-most tab.

4. The system shall contain a scrolling display of system activity. The system shall provide a scroll bar to allow the system operator to move up/down among the event messages on the screen. The system operator shall be able to scroll back through the previous 1000 transactions of system activity

5. The system shall provide an activity-monitoring screen which shall operate in multiple modes. The first mode shall allow the system operator to view all system activity, including scheduled actions, card accesses events, etc. These events shall be displayed in chronological order. The second mode shall display only those system events, which require operator action. The system shall allow the operator to view events in order based upon alarm priority or time of activation. A third mode shall allow for a split screen (on one or multiple monitors) providing the ability to display both General Events and the Alarm Events

6. The operator shall also have the ability to view additional details of the event through the use of a single keystroke. By clicking on the event item with the mouse, the operator shall be presented with alarm response instructions that have been programmed into the system

7. The system shall allow the operator to select the color that shall be used in displaying event messages on the operator workstation. The operator shall be able to choose from any of fourteen (14) colors. The event message color shall be based upon event message type and event priority.

S. Graphics

1. The system shall allow graphics and floor plans floor plans to be linked to points and events within the system. These graphics and floor plans shall be configured in a .BMP or .DXF format to allow for the importation of existing drawings.

2. The system software shall, through the use of a mouse, allow for placement of device icons on each graphic/ floor plan. The device icons which may be placed on the graphic/ floor plan shall include alarm inputs, output control points, doors and any other graphics.

3. Upon activation of a selected event, the operator shall, by the use of a single keystroke, view the associated graphic/floor plan on the monitor. The operator shall use the mouse to click on any of the icons on the graphic and issue a command associated with the icon.

4. The graphics feature shall take advantage of the Client/Server system configuration, with all graphics being created/stored on a shared disk in the network. These graphics shall be available to all authorized Operator workstations.

T. The controllers connected to the Security Management Control System shall utilize Flash ROM for storage of the operating program used to run the controller. It shall be possible to download the controller's operating program directly from the Security Management Control System. The system should not require a technician

to physically change the ROMs on the controller in order to change the controller's operating system.

1. The manufacturer of the Security Management Control System shall offer a variety of methods for distributing the flash program for the controllers. This distribution method shall include but not limited to: floppy disk, CD-ROM, and the manufacturer's web site. The controller's flash program shall be loaded on the SG Comm service and then downloaded to the controllers over the communication lines connecting the host system to the controllers.

2. System Operation

    a. The Security Management Control System shall provide the system administrator with a status display indicating the revision level of flash program currently running in each controller.

    b. The system shall provide controls allowing a privileged system operator to issue a command to download the flash program to the controllers. The operator shall be able to select which controllers shall receive the flash download and the revision level of the flash program the controllers shall receive.

    c. If a controller is not communicating with the host, or is a dial-up panel to which communications can not be established, the download of the operating program shall be delayed until communications is restored or the download request is canceled by a system operator

    d. The flash program may be downloaded to a controller but not burned into memory allowing for an opportune time to reset a controller without causing system inconvenience

3. Controller Operation

    a. While the operating program is being downloaded from the host computer, the controller shall continue to operate as normal. The flash program being downloaded shall be stored by the controller in temporary memory until the entire operating program is received. When the entire operating program is received by the controller, the controller shall provide the operator the option of when to restart. The controller shall delete the previous version of the operating program and begin running the new operating program.

    b. If the controller has insufficient space to receive the new operating program, or the complete new operating program is not received, the controller shall report this to the host computer as an invalid flash load.

2.08 ACCESS CONTROL PANEL

A. The access control panel shall be an intelligent, modular controller designed to integrate various event management applications on one controller. The system shall be the System Galaxy 600 Series.

1. The Primary Controller is the controller responsible for up/downstream communications with the PC/Network. The Primary Controller consists of

three major subsystems, software services, hardware and expansion interfaces.

a. The software services are a set of common functions and applications that shall be installed on every 600 Series Controller to perform system configuration, generic system event handling and communications between the controller and a host or other controllers.

b. Hardware

1) The 600 Series Controller shall support 10BaseT Ethernet Communication. The interface to the Ethernet services shall be through a standard RJ-45 jack connector native to the controller. Provide as many as required for full system integration.

2) The 600 Series controller shall have three (3) on-board inputs. The inputs are reserved for tamper, power fail, and low battery.

3) The Controller shall allow for "Hot-Swap" serviceability. This allows for communications and door modules to be interchanged without a controller power-down.

4) Each 600 Series Control Module shall accept a regulated input voltage of 11.5VDC to 13.8VDC and generate appropriate voltage levels for on-board use as required. The input supply voltage shall be available to be bussed directly to the reader bus connectors to supply operating voltages for field readers. A jumper shall be provided for the ACP modules supporting direct Wiegand support to supply either 12VDC or 5 VDC to the external read heads.

5) There shall be LEDs indicating the status of the received and transmitted data for the onboard communications ports, with active data turning on the LED. These LEDs shall be hardware controlled.

6) There shall be multiple ports provided on-board for external read heads, input/output boards. The number of actual ports varies according to the controller configuration.

c. Expansion Interfaces

1) 8 Supervised Class A inputs shall be provided on each Digital I/O board. These inputs shall report secure for user selectable ohms and alarm for open or short. Resistors marked for easy identification shall be located near each input connector to be clipped out by the end user when installing inputs.

2) 4 Class C relay outputs shall be provided on each Digital I/O board these outputs shall have contacts for Normally Open or Normally Closed states

a) Each 600 Controller shall support up to five (5) Digital I/O board, adding up to forty (40) supervised inputs and twenty (20) Class C relays.

B. 600 Series Access Control Panel (ACP) Software Features and Settings

1. The ACP shall provide for configuration, status and event reporting using the embedded system services.

2. An access control system selectively allows certain people to enter an area. The ACP shall allow access to identified individuals, shall control entry by time, and shall record entries. The ACP shall also allow a host to control access, or allow an access cycle to be controlled by a request-to-exit input.

3. Access Control Services

    a. Door Access Control: The Host shall allow the ACP to handle door configuration and control.

    b. The door configuration defines the behavior of a door and includes the following parameters:

        1) Inbound and Outbound Access Reader(s) – which readers are monitored at this door.

        2) Door Switch Monitor (DSM) - usually a simple switch that changes state when the door is opened or closed. The switch, if enabled, connects to a monitored input. If the DSM input becomes active while not shunted, it will generate a Door Forced Open alarm.

        3) Door Shunt Time - how long the DSM should be shunted after the door is opened for access. The configuration may also indicate whether the DSM should remain shunted for the full shunt time, instead of clearing when the door closes. If the DSM remains active after the shunt time expires, it shall generate a Door Held Open event.

        4) Request to Exit (RTE) Input – an input whose activation triggers an access cycle that allows egress through a door. The RTE Input should be placed on the protected side of the door. The configuration may indicate whether the DSM should be shunted as long as the RTE is active, and whether the DLR should be enabled for an RTE access.

        5) Door Latch Relay (DLR) – the output which controls the strike for the Door Unlock Time – the length of time, in seconds, that the DLR is energized during a valid access cycle. The DLR is normally energized for a valid access, and de-energized as soon as the door opens, but a Re-lock Delay may cause the DLR to be energized for a number of seconds after the door opens. Access grant decisions based on presented cards, RTE access based on RTE input activation, and host requests for momentary unlock of the door all cause the door to perform a valid access cycle.

        6) ADA Output – an output may be configured to activate at 1 second after the door is unlocked for valid access, for a duration of 1 second when the door is being accessed by cardholders with an ADA flag in their personnel record.

        7) Expanded Shunt Time – For certain cardholders, a longer shunt time may also be configured.

8) Door Control: The ACP shall allow door control from a host. The door mode may be set to lock, unlocked, momentarily unlocked, or access disabled modes. A momentary unlock request will start a valid access cycle process on the door.

9) Door Status Reporting: The ACP shall report door alarm status changes including door held open and door forced open.

10) Door Event Configuration: The ACP shall allow the configuration of Events that are activated by certain door events. The supported events shall include:

a) Door held open causes Event

b) Door forced causes Event

c) All valid access cause Event

d) All invalid access cause Event

4. The ACP shall allow the configuration of door groups by a host. Door groups may then be used in emergencies, or to group doors for common control.

5. The ACP shall allow reader configuration from a host. The reader configuration defines the behavior specific to a reader on a door and includes the following parameters:

a. Default PIN Mode – If a card reader includes a keypad, it may be configured to require the cardholder to enter a Personal Identification Number (PIN), in addition to presenting a card, to gain access at a door. A Time Specification may be entered to control this mode on a time basis.

b. Card formats - the card formats supported at this reader.

c. Card Entry Through Keypad – If card readers include keypads, they may be configured to allow the cardholder to enter their card number through the keypad instead of by presenting a card.

d. Exit Area – The area from which this reader exits. This parameter is not applicable for readers that are on an elevator.

e. Entry Area – The area to which this reader enters. This parameter is not applicable for readers that are on an elevator.

6. The ACP shall allow the configuration of floor groups. Floor groups are primarily used in elevator clearances.

7. Fingerprint Scanners: The ACP shall be interfaced to the Sagem Morpho fingerprint scanner through a Wiegand or ABA interface.

8. The ACP shall allow the configuration and control of inputs connected to AMMs and inputs connected to the ACP and any logical input that may be maintained by the ACP.

a. The ACP shall allow the control of inputs including arming/disarming the input.

b. The ACP shall allow the retrieving of the current status of inputs and shall log changes in input status.

c. The ACP shall allow the configuration of input Events. These Events will include:

1) Activation during a specified time specification causes Event.

2) Activation outside a specified time specification causes Event.

3) Supervision error causes Event.

4) Tamper on AMM input board or ORM board causes Event.

9. The ACP shall allow the configuration of input groups. Input groups may be referenced by Events.

10. The ACP shall allow the configuration and control of outputs connected to the ACP.

a. Output Definition: The ACP shall allow the configuration of outputs. Output configuration controls the behavior of the Output and includes Enabled/Disabled and reversed outputs.:

b. Output Control: The ACP shall allow the control of outputs, including setting the current state to activated, deactivated, or momentarily activated.

c. Output Groups: The ACP shall allow the configuration of output groups.

C. Sheet metal, of the appropriate gauge for the cabinet size per UL 294, shall be utilized. The cabinet shall be Black in color with a matte finish. The ACP's shall be housed in a locking 18 gauge metal cabinet, suitable for wall mounting. All cabinet locks shall be keyed alike. The cabinet shall be suitably sized to allow installation of the controller and all expansion modules and associated field wiring. The cabinet door shall include illuminated diagnostic indicators, which shall indicate the status of the panel. A single tamper switch shall be incorporated into the door. There shall be at least 4 mounting holes and 10 knockouts on the cabinet.

D. The Diagnostic Web Server shall generate real-time operational and diagnostic information on a networked ACP to be viewed by a user from a standard web browser, such as Netscape Navigator. This web server, residing on each ACP, shall answer requests from a standard web browser and shall generate and serve up HTML pages that indicate controller status and diagnostic information.

2.09 CARD READER

A. Provide long range proximity, minimum 8" range, type technology system.

B. Shall be single piece indoor/outdoor wall switch proximity reader providing a Wiegand 26 Bit output. Shall mount in a door entry panel electrical box and shall be powered directly from the panel. The reader shall be sealed in a rugged,

weatherized enclosure designed to withstand harsh environments as well as provide a high degree of vandal resistance when installed outdoors.

C. Electronic Reader Module

1. The unit shall be designed for wire-saving technology in the 711 ("1+n") system.

2. The unit shall be designed as an access control device functioning via the EKC 601-0, when used with the electronic card.

3. The unit shall be able to grant or deny the access to the facility upon activation by access card.

4. The unit shall support the following sequence of operations:

a. The access card presented to the reader.

b. One of two functions shall be activated:

1) Blinking green status light confirms the key is programmed into the EC 602-01 and the access is granted.

2) Blinking red status light confirms the key is not programmed into the EC 602-01 and the access is denied.

c. The control voltage to activate the illumination is 12VAC, 100mA.

d. The card/key reader shall be proximity 26 bit device with the standard Wiegand card output.

e. Manufacturer: HID Prox Point Plus or approved equal.

f. Card reader shall be flush-mounted.

g. The card reader shall be compatible with the remote control panel.

h. Coordinate the color of card readers with the Owner and Architect.

2.10 ALLOWABLE CARD ACCESS TIME LIMITS

A. Under all conditions, maximum access time shall be 0.75 seconds.

B. Maximum allowable access time is defined as the time period starting with presentation of card to reader (completed read cycle) and ending with complete actuation of door release module (or relay as applicable). It does not include the mechanical time inherent to the unlocking mechanism.

2.11 SECURITY TERMINAL CABINETS (STC)

A. Security Terminal Cabinet (STC). Shall be a metal cabinet suitable for wall mounting.

B. The following components shall be mounted in the STC:

1. Site Controller, Alarm Interfacing Panels.

2. Terminal Strips. Double row barrier terminal strips.

3. Power Supplies and Batteries

4. Tamper switch.

5. Any other equipment which is required to provide a functional, working system.

C. The dimensions of each cabinet shall not exceed 48 inches in height, 24 inches in width, or 8 inches in depth. All required components to be housed in the STC shall have a minimum 4 inches clearance on all sides. Provide multiple STC's as required for a maximum of 60% fill of each STC cabinet.

D. The terminal strips shall be mounted below the Site Controller. There shall be enough spare terminals to allow for 100% expansion. All wiring to/from terminal strips shall use spade lugs. Each wire shall be permanently labeled.

E. The STC shall have a removable back-plate assembly.

F. Access to each cabinet shall be via hinged door(s) with keyed locks. All STCs shall have the same lock and be keyed the same. Enclosures with removable covers shall be unacceptable.

G. The door shall be protected by an anti-tamper device in such a way that a tamper alarm shall be generated if any portion of any door moves more than one quarter of an inch from its closed position. This alarm shall be sent to the Computer.

H. Enclosure shall be dust tight, equivalent to Hoffman NEMA 4, 12 or 13 styles.

I. Provide Security Terminal Cabinets (STC) at locations shown on plans. STC locations shall be selected to ensure that the cable lengths are maximum 90% of the manufacturer's recommended values.

2.12 POWER SUPPLY SYSTEMS

A. The Access Control Systems shall be fed from the UPS system power at 120 volt AC.

B. The electric mortise and/or electric strike lock power supply be 24VDC, 4 Amp, 6 Amp, or 10 Amp as required by site loads. These panels shall be fed from the UPS system power at 120 volt AC. The lock power supply shall include multiple DC outputs on separate Class 2 current limited fuses, fused line voltage input, individual manual on/off switching with individual LED indicated power status. Provide quantity of BPS-24 power supplies and batteries as required to maintain maximum 75% load for each power supply set. These power supplies shall be used to power all access controlled electric door hardware. It shall be Securitron Models BPS-24-4, BPS-24-6 or BPS-24-10 or qualified and approved equal.

C. Each Security Remote Control Panel shall have sealed, no-maintenance, rechargeable batteries.

1. Sufficient power shall be included to allow the RCP to operate a minimum of 8 hours when loaded to its maximum configuration and capacities.

2. Power back-up shall be of such size and capacity that 8 hours can be increased to a minimum of 24 hours.

3. The batteries shall be enclosed in the RCP or in a Security Terminal Cabinet.

4. An alarm with descriptive message shall be generated at the Computer whenever a RCP loses AC power and is operating on battery power.

5. An alarm with descriptive message shall be generated at the Computer whenever a RCP loses back-up battery power.

2.13 LIFE SAFETY

A. Card access system shall be connected to the fire alarm system by the Security Contractor.

B. All electric doors in the pathway of building egress shall release as required by life safety code.

2.14 REQUEST FOR EGRESS PUSHBUTTON

A. The Security Contractor shall provide request for egress pushbutton.

B. An emergency pushbutton exit switch on the protected side of the door also shall be installed and located within eighteen (18) inches of the door. This emergency exit switch shall provide for egress emergency conditions by directly removing power from the electromagnetic door lock (door unlock).

C. It shall send a signal to the Security Management System multiplexer "request for exit input" which shall shunt the door contact for the associated door for the programmed exit period.

D. The emergency exit switch shall consist of a solid machined aluminum semi-recessed button mounted on a solid aluminum cover plate for mounting on a single gang backbox. It shall be vandal resistant.

2.15 MAGNETIC DOOR SWITCH

A. The door hardware supplier shall provide concealed, biased, door position sensors for all other doors that require monitoring.

B. Recessed magnetic door contacts shall be installed by the Security Contractor on all doors as defined in the contract drawings.

C. Each magnetic door contact shall be configured by the Security Contractor as a separated alarm point. Double doors and banks up to six single contiguous or three contiguous double doors shall be configured as a single alarm point.

D. All magnetic door switches shall be powered and tested by the Security Contractor.

E. Coordinate with the door and door hardware suppliers.

F. If in a unique or difficult situation and a recessed magnetic door contact is not feasible, then a surface mount contact may be substituted if it meets the requirements of a high security biased switch configuration with concealed terminals, aluminum housing and armored cable.

G. Refer to SECURITY DOOR HARDWARE SCHEDULE and the Contract Drawings.

2.16 DETECTION DEVICES

A. Request-to-Exit PIR - The REX device shall be UL listed and approved for egress application with the following features:

1. Single or double door use.

2. Wall or ceiling mountable.

3. Internal vertical pointable with wrap-around coverage pattern.

4. Up to 60 second adjustable time latch.

5. Selectable relay trigger mode and fail-safe/fail-secure.

6. Sequential logic input.

7. Door monitor with sounder and relay control.

8. Motion processing.

B. Motion Detectors - Provide Dual Technology PIR/Microwave detectors. Each sensor shall have mounting capability and coverage area specifically applicable for usage as shown on the Contract Drawings.

C. Refer to Architect's SECURITY DOOR HARDWARE SCHEDULE and the Contract Drawings.

2.17 SECURITY DOOR HARDWARE

A. The security contractor in coordination with the door hardware supplier shall provide the security components as depicted on the Contract Drawings and outlined in the Specifications.

PART 3 – EXECUTION

3.01 SYSTEM ARRANGEMENT

A. System arrangement shall be consistent with the component locations and riser diagram shown on the drawings.

B. Precise as-built mark-ups (illustrating actual field wiring arrangements and equipment configurations) shall be submitted to the Engineer.

3.02 INSTALLATION

A. Wiring:

1. It is the intent of this specification that all associated wiring (per manufacturer's requirements) shall be installed in compliance with power-limited fire protective signaling circuits in strict accordance with the National Electrical Code and shall be the responsibility of this Contractor, except that all final connections at the system control panels (in a neatly dressed fashion) shall be executed by an authorized technician who shall check for proper circuit resistance and shorts to ground prior to consummating the terminations.

2. All wiring shall be installed in dedicated electrical metallic tubing with set-screw and compression type couplings and connectors for interior dry locations and interior wet locations or exterior locations, respectively.

3. Low voltage signal and/or control wiring shall run in separate conduit/raceway from electric power cables. Cables for door locks are power cables. Provide separation from lighting fixtures and other electrical appurtenances. Provide electrical interference protection circuits as required to maintain the signal quality specified herein and required by system manufacturers.

4. The individual systems low voltage cabling shall use separate junction boxes and enclosures.

5. The minimum bend radius of all security, communication conduits provided under this project shall be 6 inches. Provide and maintain pull strings/tapes/ropes in all conduits for future installation of additional fiber optic cabling.

B. Contractor shall employ a subcontractor as an approved elevator manufacturer to interface the Card Access System to elevators.

C. Junction Boxes, Enclosures/Cabinets, Equipment Racks

1. All junction boxes and pull boxes shall be labeled. The box label shall state the system and use of cabling. The labeling shall be made with markers which are indelible when and after in contact with water and oil. Labeling of junction boxes visible to inmates shall be approved by Architect/Engineer and Owner.

2. Each box and enclosure shall contain a cabling and wiring log identifying all cabling accessible whether is connected or is passing by.

D. Grounding and Surge Protection

1. Provide single point grounding of the individual systems as recommended by IEEE and system manufacturers. Provide all cabling, bonding and insulation materials as required. Provide surge protection and clamping for all circuits. Coordinate all grounding, surge protection and clamping circuit requirements with the system manufacturers.

2. Coordinate grounding requirements with other trades and contractors to preclude closing of ground loops via peripheral equipment supplied from different electrical power sources. Provide isolation transformers and other equipment as required.

3.03 PROGRAMMING

A. General:

1. Programming shall be executed by an authorized technician.

B. Operation:

1. Expandable and reprogrammable at any time up to system's maximum capacity.

2. Operating system shall be field programmable for program changes and shall not require any factory modifications.

3. Each component shall be uniquely identified by an address code (Owner selected) entered at time of installation.

3.04 SUPERVISION

A. General:

1. Supervision and testing shall be executed by an authorized technician.

B. Supervision:

1. Provide on-site observation throughout the system construction period, lending all guidance necessary to insure a proper installation.

2. Perform the prescribed "systems demonstration" and "instruction".

3. Provide as-built drawings.

3.05 INSTRUCTION

A. Provide thorough demonstrative instruction (2, 4-hour sessions) via factory trained technicians (representatives of the manufacturer's authorized distributor), secure the Owner's written acknowledgement and submit to the Engineer.

END OF SECTION

SECTION 26 67 44

COMMUNICATIONS CABINETS, RACKS, FRAMES AND ENCLOSURES

PART 1 – GENERAL

1.01 REQUIREMENTS

A. Furnish and install communications cabinets, racks, frames and enclosures in accordance with the parameters shown on the drawings and herein specified.

B. Free standing relay racks shall be complete with vertical cable management, horizontal cable management, and all accessories (cable management spools, cable lashing bar, etc.) necessary for a complete system.

C. Equipment/systems shall conform with the applicable portions of American National Standards Institute (ANSI), Telecommunications Industry Association (TIA), Electronic Industries Alliance (EIA), Telecommunications Distribution Methods Manual, 10th Edition, Building Industry Consulting Services International (BICSI), 2006.

D. Systems shall conform with the applicable portions of the requirements set forth in the National Electrical Code (NFPA-70).

E. Components shall be tested by Underwriters Laboratories and shall bear the associated label, seal or stamp of conformance.

PART 2 – PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Chatsworth Products Inc., or approved equal.

2.02 DESCRIPTION

A. Free Standing Relay Racks (Standard Rack):

1. Racks shall be manufactured from aluminum and/or steel extrusion.

2. Each rack will have two L-shaped top angles, two L-shaped base angles and two C-shaped equipment-mounting channels. The rack will assemble with nut and bolt hardware. The base angles will be pre-punched for attachment to the floor.

3. Equipment mounting channels will be 3” deep and punched on the front and rear flange with the EIA-310-D Universal hole pattern to provide 45, rack-mount spaces relative to rack height for equipment. Each mounting space will be marked and numbered on the mounting channel.

4. When assembled with top and bottom angles, equipment-mounting channels will be spaced to allow attachment of 19” EIA rack-mount equipment. Attachment points will be threaded with 12-24 roll-formed threads. The rack

will include assembly and equipment-mounting hardware. Racks will include 50 each combination pan head, pilot point mounting screws.

5. The assembled rack will measure 8' (96") high as noted on documents, 20.3" wide and 15" deep. The sides (webs) of the equipment-mounting channels will be punched to allow attachment of vertical cable managers along the sides of the rack or for rack-to-rack baying.

6. The rack will be rated for 1,500 lb. of equipment.

7. Finish shall be either clear grained aluminum or epoxy-polyester hybrid powder coat in the color as specified below.

PART 3 – EXECUTION

3.01 INSTALLATION

A. Assemble freestanding relay racks according to manufacturer's instructions. Verify that equipment mounting rails are sized properly for rack-mount equipment before attaching the rack to the floor.

B. All racks must be attached to the floor in four places using appropriate floor mounting anchors. When placed over a raised floor, threaded rods should pass through the raised floor tile and be secured in the structural floor below.

C. Racks shall be grounded to the Telecommunications Grounding Buscar (TGB) using appropriate hardware provided by the contractor. The ground will meet local code requirements and will be approved by the Authority Having Jurisdiction (AHJ).

D. In seismic areas, the rack should have additional bracing as required by building codes and the recommendations of a licensed structural engineer.

E. Ladder rack may be attached to the top of the rack to deliver cables to the rack. The rack should not be drilled to attach ladder rack. Use appropriate hardware from the ladder rack manufacturer.

F. The equipment load should be evenly distributed and uniform on the rack. Place large and heavy equipment towards the bottom of the rack. Secure all equipment to the rack with equipment mounting screws.

END OF SECTION

SECTION 26 67 45

COMMUNICATIONS TERMINAL BLOCKS, PATCH PANELS AND PATCH CORDS/JUMPERS

PART 1 – GENERAL

1.01 REQUIREMENTS

A. Furnish and install Category 6 patch panels and patch cords/jumpers used for cross-connect distribution of Category 6 balanced unshielded twisted pair (UTP) cabling in accordance with the parameters shown on the drawings and herein specified.

B. Equipment/systems shall conform with the applicable portions of American National Standards Institute (ANSI), Institute of Electrical and Electronics Engineers (IEEE) and Federal Communications Commission (FCC), Telecommunications Distribution Methods Manual, 14th Edition, Building Industry Consulting Services International (BICSI), and Information Transport Systems Installation Manual, 8th Edition.

C. Systems shall conform with the applicable portions of the requirements set forth in the National Electrical Code (NFPA-70).

D. Components shall be tested by Underwriters Laboratories and shall bear the associated label, seal or stamp of conformance.

1.02 WARRANTY

A. The system shall be warranted by the manufacturer to be free from defects in equipment, materials and workmanship for a period of 1 year from the date of final acceptance by the Owner, during which time all above mentioned defects shall be corrected and all services incidental to proper performance shall be provided free of charge.

PART 2 – PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Hubbell NEXTSPEED or approved equal.

2.02 DESCRIPTION

A. Category 6 patch panels:

1. Design Requirements:

a. Category 6 patch panels shall be standard 8-position, RJ-45 style, un-keyed, FCC-compliant receptacle, in 48, port configurations.

b. Panel frames shall be black powder coated 14 gage steel with rolled edges top and bottom for proper stiffness.

c. Panels shall accommodate a minimum of 24 ports for each rack mount unit (1 RMU = 1.75 in.).

d. Panels shall be designed for 4-pair, 100 ohm balanced unshielded twisted pair (UTP) cable.

e. Panels shall terminate 26-22 AWG solid conductors, with maximum insulation diameter of 0.050 in.

f. Panels shall have attached wiring instruction labels to permit either T568A or T568B wiring configurations.

g. Panels shall have individual port identification numbers on the front and rear of the panel.

h. Panels shall utilize 8-port adapter modules, each secured with two screws. Adapter module housings shall be UL 94 V-0 rated thermoplastic.

i. Panel adapter modules shall be 110-style termination with tin lead solder plated IDC contacts.

j. Panels shall have a temperature rating of -10 °C (14°F) to 70°C (158 °F).

k. Printed circuit boards shall be fully enclosed front and rear for physical protection.

l. Panel contacts shall accept a minimum of 2000 mating cycles without degradation of electrical or mechanical performance.

m. Panel contacts shall maintain a minimum deflection force of 100 grams while mated with an FCC-standard RJ-45 plug.

n. Panel contacts shall be formed flat for increased surface contact with mated plugs.

o. Panel contacts shall be arranged on the PC board in 2 staggered arrays, one array having 6 contacts and the other array having 2 contacts.

p. Panel contacts shall be constructed of Beryllium copper for maximum spring force and durability.

q. Contact plating shall be a minimum of 50 micro-inches of hard gold in the contact area over 50 micro-inch of nickel.

r. Panel termination method shall follow the industry standard 110 IDC punch-down, using a standard 110 impact termination tool.

s. Panels shall be compatible with a 4-pair multi-punch impact termination tool designed specifically for the purpose. Bending or other damage to the panel using a multi-pair punch tool shall not occur.

t. IDC contact termination towers shall have tapered pair-splitting features to aid wire insertion and minimize pair un-twist.

u. IDC contacts shall be arranged in staggered arrays of 4 sets of 2 contacts.

v. Panels shall have the Category 6 designation, visible from the front when installed.

w. Panels shall utilize a paired punch-down sequence to maximize electrical performance.

x. IDC contacts shall be Phosphor Bronze with 100 micro-inch tin lead 60/40 plating over nickel.

y. Panels shall not require special cords, specialty tools or special installation requirements.

z. Panel adapter ports shall accept FCC compliant 6 position plugs, optional hinged dust covers and snap-on icons for specific identification.

aa. Space above the adapter ports shall be available for additional labeling per ANSI/TIA/EIA-606-A.

bb. Category 6 panels shall be backward compatible with existing Category 3, 5 and 5e cabling systems for fit, form, and function.

2. Performance Requirements:

a. All transmission performance parameters shall be independently verified by a UL or ETL third party testing organization.

b. Category 6 panels shall meet or exceed Category 6 transmission requirements for connecting hardware, as specified in ANSI/TIA/EIA-568-B.2-1 Transmission Performance Specifications for 4-Pair 100 ohm Category 6 Cabling.

c. The manufacturer shall provide Category 6 component compliance certificates from third party testing organizations upon request.

d. Panels shall exceed IEEE 802.3af DTE Power specification to 4 times the rated current limits with no degradation of performance or materials.

e. Panels shall be third party verified, error free Gigabit Ethernet performance to IEEE 802.3ab.

f. Category 6 panels shall meet or exceed the 4-connector channel performance requirements of Category 6, per the ANSI/TIA/EIA-568-B.2-10 standard.

g. The 4-connector channel test configuration shall utilize Category 6 patch panels, Category 6 jack, and Category 6 patch cords, from the same manufacturer, with qualified Category 6 cable.

h. The 4-connector channel performance margins in the table below shall be guaranteed. Conditions of requirement No. g above apply exclusively.

i. Category 6 panels shall meet the current draft 10 Gb/s performance requirements of IEEE 802.3an and TSB-155, for a maximum 55-meter

channel length. Conditions of requirement no. g above apply exclusively.

ELECTRICAL PARAMETER (1 - 250MHZ)	GUARANTEED MARGINS TO CATEGORY 6 / CLASS E CHANNEL SPECIFICATIONS
Insertion Loss	3 %
NEXT	4 dB
PSNEXT	5 dB
ELFEXT	4 dB
PSELFEXT	5 dB
Return Loss	2 dB

B. Category 6 patch cords/jumpers:

1. Design Requirements:

a. Category 6 patch cable, 24 AWG 7132 tinned copper stranded conductors, insulated with polyethylene and UL flame-retardant PVC jacket.

b. Length as required to meet needs.

c. Color as noted on floor plans and/or details.

d. Factory terminated, double ended, third party component tested and verified.

PART 3 – EXECUTION

3.01 PREPARATION

A. Horizontal and backbone cabling of the proper category shall be fully deployed into the TR, TE or ER according to applicable codes and standards.

B. Cable slack, service loops, bend radii, and pathway fill ratio shall comply with applicable codes and standards.

C. Metallic horizontal cable pathways shall be bonded to an approved ground.

D. Cable ends for termination shall be clean and free from crush marks, cuts, or kinks left from pulling operations.

3.02 INSTALLATION

A. Properly mount patch panels into the designated rack, cabinet, or bracket locations with the #12-24 screws provided.

B. Terminate cables into the patch panel according to manufacturer’s instructions.

C. To maximize transmission performance, maintain wiring pair twists as close as possible to the point of termination.

D. The length of wiring pair un-twist in each termination shall be less than 0.5 inches (13 mm).

E. Horizontal or backbone cables extending from the panel terminations shall maintain a minimum bend radius of at least 4 times the cable diameter.

F. Cable terminations shall have no tensile or bending strain on panel IDC contacts in each installed location.

G. For horizontal cabling, jacks shall be terminated with faceplates assembled complete and properly mounted.

H. Consolidation point equipment, where applicable, shall also be fully installed and terminated prior to testing.

I. Panels shall be properly labeled on front and back with the cable number and port connections for each port.

3.03 FIELD QUALITY CONTROL – TESTING

A. Panels shall be tested as part of the installed horizontal or backbone cabling system.

B. Each link or channel in the horizontal or backbone cabling system shall be identified and tested individually, using an industry standard level III tester with proper settings, including the correct cable NVP value.

C. Each backbone or horizontal link/channel shall be tested to Category 6 parameters listed in the table below. (Note: a level III tester will produce all results below automatically)

Wire Map / Continuity	Length	Insertion Loss
NEXT	PSNEXT	ELFEXT
PSELFEXT	Delay and Delay Skew	Return Loss

D. A "PASS" indication shall be obtained for each channel or link, using a level III tester.

E. Completed test reports shall be submitted per contract requirements of Division 01 Section 01 33 19: Field Test Reporting.

END OF SECTION

SECTION 26 67 46

COMMUNICATIONS CABLE MANAGEMENT

PART 1 – GENERAL

1.01 REQUIREMENTS

A. Furnish and install communications cable management system in accordance with the parameters shown on the drawings and herein specified.

B. System shall include vertical cable management, horizontal cable management, and all accessories (cable management spools, cable lashing bar, etc.) necessary for a complete system.

C. Systems shall conform with the applicable portions of American National Standards Institute (ANSI), Telecommunications Industry Association (TIA), Electronic Industries Alliance (EIA), Telecommunications Distribution Methods Manual, 14th Edition and Building Industry Consulting Services International (BICSI).

D. Systems shall conform with the applicable portions of the requirements set forth in the National Electrical Code (NFPA-70, 2020 Edition).

PART 2 – PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Chatsworth Products Inc., or approved equal.

2.02 DESCRIPTION

A. Vertical Cable Management for Racks/Frames (Evolution™ Cable Management):

1. Every rack/frame shall have a minimum of one vertical cable manager. The vertical cable manager shall create a space for storing and organizing cables along the side of the rack/frame. The cable manager shall maintain separation between patch/equipment/jumper cords and premise cables.

2. The vertical cable manager shall match the height of the rack(s)/frame(s).

3. The vertical cable manager shall bolt to the side of racks/frames with included hardware.

4. The cable manager shall be sized to match cabling requirements. The initial quantity of cables within the cable manager shall not exceed a whole number value equal to 40% of the interior area of the cable manager.

5. A single vertical cable manager may be used in between bayed racks/frames if it is sized to match cable requirements for both racks/frames.

6. The vertical cable manager shall be a single-sided C-shaped trough with a door or a double-sided H-shaped trough with two doors. The single-sided trough shall provide a single pathway. Three fixed position accessory

mounting panels shall allow attachment of cable management accessories at the back of the manager. The double-sided trough shall provide independent front and rear cable pathways and shall have three movable mid-sections to hold cable management accessories. The movable mid-sections shall adjust front-to-rear to allow a 40/60, 50/50 or 60/40 front/rear split of the interior cable management space. The back of both managers shall be mostly open to allow easy cable pass-through.

7. The door shall be removable, hinged to open from the right or left side, with a two-point latch and a single knob on the right and left side to secure the door in the closed position. The front door on single- and double-sided managers shall have a two-tone finish: black with a vertical aluminum panel at the center. The rear door on double-sided cable managers shall be flat with a black finish.

8. The vertical cable manager shall have cable openings along both sides of the trough. The openings shall be formed by evenly-spaced T-shaped cable guides. The T-shaped cable guides shall be made from a composite plastic material (not metal) and shall have rounded edges to protect cables. When the cable manager is attached to a rack/frame, each cable opening shall align with a rack-mount space (RMU) on the rack/frame. Each opening shall pass a minimum of 24 each .25" OD patch cords.

9. The cable manager shall be delivered individually boxed, and available in several widths as specified below and in the contract documents.

10. The vertical cable manager shall be manufactured from steel, aluminum and plastic.

11. Finish shall be epoxy-polyester hybrid powder coat paint to match the communications rack. T-shaped cable guides and latch hardware shall be black.

12. Internal cable management accessories will include cable management spools that attach to the panels/mid-sections to provide slack management for patch cords; a cable lashing bar kit to provide tie points for cable bundles at the rear/mid of the manager; and a fiber segregation kit that creates a separate pathway inside the manager to separate fiber from other cables.

B. Horizontal Cable Management for Racks/Frames (Evolution™ Cable Management):

1. Place horizontal cable managers above and below each patch panel on/in each rack/frame. The horizontal cable manager will guide patch/equipment cords between the vertical cable manager and individual network port connections.

2. The horizontal cable manager shall match the rack-mount width of the rack(s)/frame(s).

3. The horizontal cable manager shall attach to the front or rear of the rack/frame with screws and shall be sized to fit in standard EIA-310-D (1-3/4" high RMU) rack-mount spacing.

4. The horizontal cable manager shall be sized to match cabling requirements. Provide a minimum of 1 RMU of horizontal cable management for every 2

RMU of connectivity. Cables must be able to access the cable manager so that no ports are blocked by the cables.

5. A single horizontal cable manager may be used to support multiple patch panels as long as it is sized to match cable fill requirements. Cables must be able to access the cable manager so that no ports are blocked by the cables.

6. The horizontal cable manager shall be a single-sided C-shaped trough with a cover. 2 RMU and 3 RMU high cable managers shall have three edge-protected oval openings at the rear to facilitate front-to-rear cabling through the horizontal manager. The front of the cable manager shall have T-shaped cable guides along the top and bottom surfaces of the cable manager. Evenly spaced cable openings in between the T-shaped cable guides shall allow cables to enter/exit the cable manager from/into the rack-mount space. The cover shall be removable, hinged to open up or down and shall snap on to secure the cover in the closed position.

7. The horizontal cable manager shall be delivered individually boxed, and available in the width(s) and height(s) as specified below and in the contract documents.

8. The horizontal cable manager shall be manufactured from steel, aluminum and plastic.

9. Finish shall be epoxy-polyester hybrid powder coat paint to match the communications rack. Edge-protectors, T-shaped cable guides and latch hardware shall be black.

PART 3 – EXECUTION

3.01 INSTALLATION

A. Vertical Cable Managers:

1. Attach vertical cable managers to the side of the rack/frame using the manufacturer's installation instructions and included hardware.

2. When a single vertical cable manager is used in between two racks/frames, attach the vertical cable manager to both racks/frames.

3. When more than one cable manager is used on a rack/frame or group of racks/frames, use the same make, style and size of vertical cable manager on the rack/frame or in between racks/frames.
4. The color of the rack(s)/frame(s) and cable manager(s) must match.

5. Doors shall be attached to the cable manager and in the closed position after cabling is complete.

B. Horizontal Cable Managers:

1. When more than one horizontal cable manager is used on a rack/frame or group of racks/frames, use the same make and style of cable manager on the rack/frame or racks/frames.

2. The color of the rack(s)/frame(s) and cable manager(s) must match.

3. Attach horizontal cable managers to the rack/frame with four screws according to the manufacturer's installation instructions. Each cable manager shall be centered within the allocated rack-mount space (RMU).

4. Horizontal managers shall be located so that the number of ports (cables) that each manager supports shall not exceed each cable manager's cable fill capacity.

5. Covers shall be attached to the cable manager and in the closed position after cabling is complete.

END OF SECTION

SECTION 26 67 47

GROUNDING AND BONDING FOR COMMUNICATIONS SYSTEMS

PART 1 – GENERAL

1.01 REQUIREMENTS

A. Furnish and install grounding and bonding for communications systems in accordance with the parameters shown on the drawings and herein specified.

B. System components shall be Underwriters Laboratories Listed as grounding and bonding equipment.

C. Systems shall conform with the applicable portions of American National Standards Institute (ANSI), Telecommunications Industry Association (TIA), Electronic Industries Alliance (EIA), Telecommunications Distribution Methods Manual, 14th Edition and Building Industry Consulting Services International (BICSI).

D. Systems shall conform with the applicable portions of the requirements set forth in the National Electrical Code (NFPA-70, 2023 Edition).

PART 2 – PRODUCTS

2.01 WALL-MOUNT BUSBARS

A. Telecommunications Main Grounding Busbar (TMGB):

1. Telecommunications Main Grounding Busbar (TMGB) shall be constructed of 0.25” thick solid copper bar.

2. The busbar shall be 4” high and 20” long and shall have 30 attachment points (two rows of 15 each) for two-hole grounding lugs.

3. The hole pattern for attaching grounding lugs shall meet the requirements of ANSI-J-STD – 607-A and shall accept 27 lugs with 5/8” hole centers and 3 lugs with 1” hole centers.

4. The busbar shall include wall-mount stand-off brackets, assembly screws and insulators creating a 4” standoff from the wall.

B. Telecommunications Grounding Busbar (TGB):

1. Telecommunications Grounding Busbar (TGB) shall be constructed of 0.25” thick solid copper bar.

2. The busbar shall be 2” high and 12” long and shall have 9 attachment points (one row) for two-hole grounding lugs.

3. The hole pattern for attaching grounding lugs shall meet the requirements of ANSI-J-STD – 607-A and shall accept 6 lugs with 5/8” hole centers and 3 lugs with 1” hole centers.

4. The busbar shall include wall-mount stand-off brackets, assembly screws and insulators creating a 4" standoff from the wall.

2.02 RACK-MOUNT BUSBAR

A. Horizontal Rack Busbar:

1. Horizontal rack-mount busbar shall be constructed of 3/16" thick by 3/4" high hard-drawn electrolytic tough pitch 110 alloy copper bar.

2. Bar shall be 19" EIA or 23" rack mounting width (as specified below) for mounting on relay racks or in cabinets.

3. Bar shall have eight 6-32 tapped ground mounting holes on 1" intervals and four 0.281" holes for the attachment of two-hole grounding lugs.

4. Each bar shall include a copper splice bar of the same material (to transition between adjoining racks) and two each 12-24 x ¾" copper-plated steel screws and flat washers for attachment to the rack or cabinet.

B. Vertical Rack Busbar:

1. Vertical rack-mount busbar shall be constructed of 1/4" thick by 5/8" high hard-drawn electrolytic tough pitch 110 alloy copper bar.

2. Bar shall be 72" or 36" high (as specified below) for mounting vertically on relay racks.

3. 72" high bar shall have 13 threaded 1/4-20 attachment points for two-hole lugs with 5/8" hole centers and two pairs of threaded studs (one at top, one at bottom) for two-hole lugs with 1" hole centers.

4. 36" high bar shall have 8 threaded 1/4-20 attachment points for two-hole lugs with 5/8" hole centers and one pair of threaded studs for a two-hole lug with 1" hole centers.

5. Each bar shall include a #2 AWG two-hole compression lug for 1" hole centers, insulator blocks and mounting screws.

C. Vertical Rack Ground Bar:

1. Vertical rack-mount ground bar shall be constructed of 0.05" thick by 0.68" wide tinned copper strip.

2. Bar shall be 78" high for mounting vertically on relay racks and shall have holes punched on 5/8"-5/8"-1/2" alternating vertical centers to match the EIA-310-D Universal Hole Pattern for a 45 RMU rack.

3. Each bar shall include three #12-24 zinc-plated thread forming hex washer head installation screws, an abrasive pad and antioxidant joint compound.

2.03 BONDING ACCESSORIES

A. Two Mounting Hole Ground Terminal Block:

1. Ground terminal block shall be made of electroplated tin aluminum extrusion.

2. Ground terminal block shall accept conductors ranging from #14 AWG through 2/0.

3. The conductors shall be held in place by two stainless steel set screws.

4. Ground terminal block shall have two 1/4" holes spaced on 5/8" centers to allow secure two-bolt attachment to the rack or cabinet.

B. Compression Lugs:

1. Compression lugs shall be manufactured from electroplated tinned copper.

2. Compression lugs shall have two holes spaced on 5/8" or 1" centers, as stated below, to allow secure two bolt connections to busbars.

3. Compression lugs shall be sized to fit a specific size conductor, sizes #6 to 4/0, as stated below.

C. Antioxidant Joint Compound:

1. Oxide inhibiting joint compound for copper-to-copper, aluminum-to-aluminum or aluminum-to-copper connections.

D. C-Type, Compression Taps:

1. Compression taps shall be manufactured from copper alloy.

2. Compression taps shall be C-shaped connectors that wrap around two conductors forming an irreversible splice around the conductors; installation requires a hydraulic crimping tool.

3. Compression taps shall be sized to fit specific size conductors, sizes #2 AWG to 4/0, as stated below.

E. Pedestal Clamp With Grounding Connector:

1. Pedestal clamp shall be made from electroplated tinned copper or bronze. Installation hardware will be stainless steel.

2. Pedestal clamps shall be sized to fit a specific size conductor, size #6 and/or 2/0, as stated below.

3. Pedestal clamp installation hardware shall be sized to attach to round and/or square raised access floor pedestals that are 1-1/8" to 1-3/4" in diameter, as stated below.

4. Pedestal clamp shall provide straight (in-line) or cross (intersection) support for up to two conductors.

F. Pipe Clamp With Grounding Connector:

1. Pipe clamp shall be made from electroplated tinned bronze. Installation hardware will be stainless steel.

2. Pipe clamp shall be sized to fit up to two conductors ranging in size from #6 to 250 MCM; conductors must be the same size.

3. Pipe clamp installation hardware shall be sized to attach to pipes, sizes 1" to 6" (0.75" to 6.63" in diameter), as stated below.

G. Equipment Ground Jumper Kit:

1. Kit includes one 24"L insulated ground jumper with a straight two hole compression lug on one end and an L-shaped two hole compression lug on the other end, two plated installation screws, an abrasive pad and a .5 once tube of antioxidant joint compound.

2. Ground conductor is an insulated green/yellow stripe #6 AWG wire.

3. Lugs are made from electroplated tinned copper and have two mounting holes spaces 0.5" to 0.625" apart that accept 1/4" screws.

PART 3 – EXECUTION

3.01 INSTALLATION

A. Wall-Mount Busbars:

1. Attach busbars to the wall with appropriate hardware according to the manufacturer's installation instructions.

2. Conductor connections to the TMGB or TGB shall be made with two-hole bolt-on compression lugs sized to fit the busbar and the conductors.

3. Each lug shall be attached with stainless steel hardware after preparing the bond according to manufacturer recommendations and treating the bonding surface on the busbar with antioxidant to help prevent corrosion at the bond.

4. The wall-mount busbar shall be bonded to ground as part of the overall Telecommunications Bonding and Grounding System.

B. Rack-Mount Busbars and Ground Bars:

1. When a rack or cabinet supports active equipment or any type of shielded cable or cable termination device requiring a ground connection, add a rack-mount horizontal or vertical busbar or ground bar to the rack or cabinet. The rack-mount busbar or ground bar provides multiple bonding points on the rack for rack and rack-mount equipment.

2. Attach rack-mount busbars and ground bars to racks or cabinets according to the manufacturer's installation instructions.

3. Bond the rack-mount busbar or ground bar to the room's TMGB or TGB with appropriately sized hardware and conductor.

C. Ground Terminal Block:

1. Every rack and cabinet shall be bonded to the TMGB or TGB.

2. Minimum bonding connection to racks and cabinets shall be made with a rack-mount two-hole ground terminal block sized to fit the conductor and rack and installed according to manufacturer recommendations.

3. Remove paint between rack/cabinet and terminal block, clean surface and use antioxidant between the rack and the terminal block to help prevent corrosion at the bond.

D. Pedestal Clamp:

1. At minimum, bond every sixth raised access floor pedestal with a minimum #6 AWG conductor to the TMGB or TGB using a pedestal clamp sized to fit the pedestal and the conductor and installed according to the manufacturer's recommendations.

2. If pedestal clamps are used to construct a signal reference grid, bond the signal reference grid to the TMGB or TGB and bond each rack and/or cabinet to the signal reference grid using a compression tap or similar non-reversible bonding component sized to fit both conductors.

3. Remove paint between the pedestal and pedestal clamp, clean surface and use antioxidant between the pedestal and the clamp to help prevent corrosion at the bond.

4. Remove insulation from conductors where wires attach to the pedestal clamp.

E. Pipe Clamp:

1. Bond metal pipes located inside the data center computer room with a minimum #6 AWG conductor to the TMGB or TGB using a pipe clamp sized to fit the pipe and the conductor and installed according to the manufacturer's recommendations.

2. Remove paint between the pipe and pipe clamp, clean surface and use antioxidant between the pipe and the clamp to help prevent corrosion at the bond.

3. Remove insulation from conductors where wires attach to the pipe clamp.

F. Equipment Ground Jumper Kit:

1. Bond equipment to a vertical rack-mount busbar or groundbar using ground jumper according to the manufacturer's recommendations.

2. Clean the surface and use antioxidant between the compression lugs on the jumper and the rack-mount busbar or groundbar to help prevent corrosion at the bond.

END OF SECTION

SECTION 26 67 48 A

COMMUNICATIONS CABLE – COPPER (CAT6)

PART 1 – GENERAL

1.01 REQUIREMENTS

A. Furnish and install data and voice cable in accordance with the parameters shown on the drawings and herein specified.

B. Cable shall be the unshielded twisted pair type, Category 6; Underwriters Laboratories listed, ANSI/TIA/EIA compliant; complete with conductors, insulation, ripcord, jacket and identification.

PART 2 – PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. TE Connectivity, Berk-Tek, or approved equal.

2.02 DESCRIPTION

A. Conductors (4 pair):

1. Material:

a. Copper.

2. Construction:

a. Solid, 23 AWG.

B. Insulation:

1. FEP (fluorinated ethylene propylene).

C. Jacket:

1. Plenum rated, 100% low smoke, flame-retardant polyvinyl chloride, blue.

2. -20C to 60C.

D. Identification:

1. Clearly marked (at 2'-0" intervals) size, type, voltage, UL label.

E. Color coding:

1. Pair No. 1:

a. White/blue stripe and blue.

2. Pair No. 2:

a. White/orange stripe and orange.

3. Pair No. 3:

a. White/green stripe and green.

4. Pair No. 4:

a. White/brown stripe and brown.

F. Performance:

1. 100 MHZ

Insertion Loss	19.8
Return Loss	20.1
NEXT	44.3
PSNEXT	42.3
ACR	24.5
PSACR	22.5
ACRF (ELFEXT)	27.8
PSACRF (PSELFEXT)	24.8

2. 250 MHZ

Insertion Loss	32.8
Return Loss	17.3
NEXT	38.3
PSNEXT	36.3
ACR	5.5
PSACR	3.5
ACRF (ELFEXT)	19.8
PSACRF (PSELFEXT)	16.9

PART 3 – EXECUTION

3.01 ARRANGEMENT

A. Arrangement shall be consistent with the component locations and riser diagram shown on the drawings.

B. Precise as-built markups (illustrating actual field arrangements and component configurations) shall be submitted to the Engineer.

3.02 PREPARATION

A. Cable slack, service loops, bend radii, and pathway fill ratio shall comply with applicable codes and standards.

B. Metallic horizontal cable pathways shall be bonded to an approved ground.

C. Cable ends for termination shall be clean and free from crush marks, cuts, or kinks left from pulling operations.

3.03 INSTALLATION

A. It is the intent of this specification that all cabling shall be the responsibility of this Contractor, including all terminations and cable system testing.

B. Concealed cable within partitions and penetrations through partitions or floors shall be installed in dedicated electrical metallic tubing with set screw type couplings and connectors.

C. Terminate cables into the patch panel according to manufacturer's instructions.

D. To maximize transmission performance, maintain wiring pair twists as close as possible to the point of termination.

E. The length of wiring pair un-twist in each termination shall be less than 0.5 inches (13 mm).

F. Horizontal or backbone cables extending from the panel terminations shall maintain a minimum bend radius of at least 4 times the cable diameter.

G. Cable terminations shall have no tensile or bending strain on panel IDC contacts in each installed location.

H. For horizontal cabling, jacks shall be terminated with faceplates assembled complete and properly mounted.

I. Panels shall be properly labeled on front and back with the cable number and port connections for each port.

3.04 FIELD QUALITY CONTROL – TESTING

A. Panels shall be tested as part of the installed horizontal or backbone cabling system.

B. Each link or channel in the horizontal or backbone cabling system shall be identified and tested individually, using an industry standard level III tester with proper settings, including the correct cable NVP value.

C. Each backbone or horizontal link/channel shall be tested to Category 6 parameters listed in the table below. (Note: a level III tester will produce all results below automatically)

Wire Map / Continuity	Length	Insertion Loss
NEXT	PSNEXT	ELFEXT
PSELFEXT	Delay and Delay Skew	Return Loss

D. A "PASS" indication shall be obtained for each channel or link, using a level III tester.

E. Completed test reports shall be submitted to the architect, engineer, and owner

3.05 LABELING

A. All backbone cables are to be labeled using a machine printed label at each end of the cable at approximately 12 inches of the termination point, and again at approximately 48 inches from the termination point. Handwritten labels shall not be used.

B. All wiring blocks, connector panels, or other termination points shall be labeled with the cable identifier as well as the pair or conductor identifier.

C. The labels shall denote, at a minimum, the starting and end points of the cable, as well as a unique cable identifier, i.e. FTO-A.FTO-B-1.

D. Note all labeling information on the as-built drawings.

END OF SECTION

SECTION 26 67 48 B

COMMUNICATIONS CABLE – COPPER (CAT 5E)

PART 1 – GENERAL

1.01 REQUIREMENTS

A. Furnish and install data and voice cable in accordance with the parameters shown on the drawings and herein specified.

B. Cable shall be the unshielded twisted pair type, Category 5E; Underwriters Laboratories listed, ANSI/TIA/EIA compliant; complete with conductors, insulation, ripcord, jacket and identification.

PART 2 – PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. TE Connectivity, Berk-Tek, or approved equal.

2.02 DESCRIPTION

A. Conductors (4 pair):

1. Material:

a. Copper.

2. Construction:

a. Solid, 24 AWG.

B. Insulation:

1. FEP (fluorinated ethylene propylene).

C. Jacket:

1. Plenum rated, 100% low smoke, flame-retardant polyvinyl chloride, blue.

2. -20C to 60C.

D. Identification:

1. Clearly marked (at 2'-0" intervals) size, type, voltage, UL label.

E. Color coding:

1. Pair No. 1:

a. White/blue stripe and blue.

2. Pair No. 2:

a. White/orange stripe and orange.

3. Pair No. 3:

a. White/green stripe and green.

4. Pair No. 4:

a. White/brown stripe and brown.

F. Performance:

1. 100 MHZ

Insertion Loss	22.0
Return Loss	14.0
NEXT	35.3
PSNEXT	32.3
ACRF (ELFEXT)	23.8
PSACRF (PSELFEXT)	20.8

PART 3 – EXECUTION

3.01 ARRANGEMENT

A. Arrangement shall be consistent with the component locations and riser diagram shown on the drawings.

B. Precise as-built markups (illustrating actual field arrangements and component configurations) shall be submitted to the Engineer.

3.02 PREPARATION

A. Cable slack, service loops, bend radii, and pathway fill ratio shall comply with applicable codes and standards.

B. Metallic horizontal cable pathways shall be bonded to an approved ground.

C. Cable ends for termination shall be clean and free from crush marks, cuts, or kinks left from pulling operations.

3.03 INSTALLATION

A. It is the intent of this specification that all cabling shall be the responsibility of this Contractor, including all terminations and cable system testing.

B. Concealed cable within partitions and penetrations through partitions or floors shall be installed in dedicated electrical metallic tubing with set screw type couplings and connectors.

C. Terminate cables into the patch panel according to manufacturer’s instructions.

D. To maximize transmission performance, maintain wiring pair twists as close as possible to the point of termination.

E. The length of wiring pair un-twist in each termination shall be less than 0.5 inches (13 mm).

F. Horizontal or backbone cables extending from the panel terminations shall maintain a minimum bend radius of at least 4 times the cable diameter.

G. Cable terminations shall have no tensile or bending strain on panel IDC contacts in each installed location.

H. For horizontal cabling, jacks shall be terminated with faceplates assembled complete and properly mounted.

I. Panels shall be properly labeled on front and back with the cable number and port connections for each port.

3.04 FIELD QUALITY CONTROL – TESTING

A. Panels shall be tested as part of the installed horizontal or backbone cabling system.

B. Each link or channel in the horizontal or backbone cabling system shall be identified and tested individually, using an industry standard level III tester with proper settings, including the correct cable NVP value.

C. Each backbone or horizontal link/channel shall be tested to Category 6 parameters listed in the table below. (Note: a level III tester will produce all results below automatically)

Wire Map / Continuity	Length	Insertion Loss
NEXT	PSNEXT	ELFEXT
PSELFEXT	Delay and Delay Skew	Return Loss

D. A "PASS" indication shall be obtained for each channel or link, using a level III tester.

E. Completed test reports shall be submitted to the architect, engineer, and owner

3.05 LABELING

A. All backbone cables are to be labeled using a machine printed label at each end of the cable at approximately 12 inches of the termination point, and again at approximately 48 inches from the termination point. Handwritten labels shall not be used.

B. All wiring blocks, connector panels, or other termination points shall be labeled with the cable identifier as well as the pair or conductor identifier.

C. The labels shall denote, at a minimum, the starting and end points of the cable, as well as a unique cable identifier, i.e. FTO-A.FTO-B-1.

D. Note all labeling information on the as-built drawings.

END OF SECTION

SECTION 26 67 48 C

COMMUNICATIONS CABLE – FIBER OPTIC

PART 1 – GENERAL

1.01 REQUIREMENTS

A. Furnish and install data and voice cable in accordance with the parameters shown on the drawings and herein specified.

B. Cable shall be the optical fiber cable; Underwriters Laboratories listed, ANSI/TIA/EIA compliant; complete with cable jacket, strengthening fibers, coating, cladding, core and identification.

PART 2 – PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Belkin, Corning or approved equal.

2.02 DESCRIPTION

A. Cable construction:

1. Optical fibers shall be placed inside a loose buffer tube. The nominal outer diameter of the buffer tube shall be 2.5 mm.

2. Each buffer tube shall contain up to 12 fibers.

3. The fibers shall not adhere to the inside of the buffer tube.

4. Each fiber shall be distinguishable by means of color coding in accordance with TIA/EIA-598, "Optical Fiber Cable Color Coding."

5. The fibers shall be colored with ultraviolet (UV) curable inks. In buffer tubes containing multiple fibers, the colors shall be stable across the specified storage and operating temperature ranges, and not subject to fading or smearing onto each other. Colors shall not cause fibers to stick together.

6. Buffer tubes containing fibers shall be color coded with distinct and recognizable colors in accordance with TIA/EIA-598, "Optical Fiber Cable Color Coding."

7. Each buffer tube shall contain a water blocking element for water-blocking protection. The water swellable element shall be non-nutritive to fungus, electrically non-conductive, and homogenous. It shall also be free from dirt and foreign matter. This element will preclude the need for other water-blocking material; the buffer tubes shall be gel-free.

8. The optical fibers shall not require cleaning before placement into a splice tray or fan-out kit.

9. The buffer tubes shall be resistant to kinking.

10. Single Tube Constructions:

    a. Cables containing 2-12 fibers of a single type shall consist of a single central buffer tube.

    b. Water swellable dielectric strength members shall be applied evenly around the outside of the buffer tube for tensile strength. The dielectric strength members shall be non-nutritive to fungus and electrically nonconductive. They shall also be free from dirt and foreign matter.

    c. Water blocking shall be provided by the strength members, which are impregnated with a water swellable compound.

11. Double Tube Constructions:

    a. Cables containing 14-24 fibers of a single fiber type, or hybrid cables containing 4-24 fibers of two distinct fiber types and with no more than 12 fibers of either type, shall consist of two buffer tubes. All of the fibers in each buffer tube shall be of the same fiber type.

    b. The buffer tubes shall be stranded together with a dielectric anti-buckling member and water blocking yarn using the reverse oscillation, or "S-Z," stranding process.

    c. The anti-buckling member shall consist of a dielectric, glass reinforced plastic (GRP) rod.

    d. Two polyester yarn binders shall be applied contra helically with sufficient tension to secure each buffer tube to the anti-buckling member without crushing the buffer tubes. The binders shall be non-hygroscopic, non-wicking and dielectric with low shrinkage.

    e. A water blocking tape shall be applied longitudinally around the outside of the cable core. The tape shall be held in place by a single polyester binder yarn. The water blocking tape shall be non-nutritive to fungus, and electrically non-conductive. It shall also be free from dirt and foreign matter.

    f. Dielectric strength members shall be applied around the outside of the cable core for tensile strength. The dielectric strength members shall be non-nutritive to fungus, electrically non-conductive and homogenous. They shall also be free from dirt and foreign matter.

12. Cables shall contain at least one ripcord under the outer sheath to facilitate its removal.

13. Cables shall be sheathed with flame-retardant polyvinyl chloride (PVC). Jacketing material shall be applied directly over the tensile strength members and water blocking tape. The PVC shall contain carbon black, or a UV stabilized colored compound to provide ultraviolet light protection and shall not promote the growth of fungus.

14. Cable jackets shall be capable of being colored any of the 12 colors identified in EIA/TIA-598, "Optical Fiber Cable Color Coding", if requested to enhance cable identification. Colored jackets shall contain UV stabilizers to provide ultraviolet light protection.

15. The jacket shall be continuous, free from pinholes, splits, blisters, or other imperfections. The jacket shall have a consistent, uniform thickness; jackets extruded under high pressure are not acceptable. The jacket shall be smooth, as is consistent with the best commercial practice. The jacket shall provide the cable with a tough, flexible, protective coating, able to withstand the stresses expected in normal installation and service.

16. Cable jackets shall be marked with the manufacturer's name or file number, month and year of manufacture, flame rating, listing mark, sequential length markings every two feet, and a telecommunication handset symbol. The actual length of the cable shall be within -0/+1% of the length markings. The print color shall be white, with the exception that cable jackets containing one or more coextruded white stripes, which shall be printed in light blue. The height of the marking shall be approximately 2.5 mm.

17. If the initial marking fails to meet the specified requirements (i.e., improper text statement, color, legibility, or print interval), the cable may be remarked using a contrasting alternate color. The numbering sequence will differ from the previous numbering sequence, and a tag will be attached to both the outside end of the cable and to the reel to indicate the sequence of remarking. The preferred remarking color will be yellow. The secondary choice will be blue.

18. Tensile Rating:

    a. Single Buffer Tube Constructions:

        1) The maximum pulling tension shall be 1350 N (300 lbf) during installation (short term) and 400 N (90 lbf) installed (long term).

    b. Double Tube Constructions:

        1) The maximum pulling tension shall be 2700 N (600 lbf) during installation (short term) and 810 N (180 lbf) installed (long term).

19. The cable shall be all-dielectric except as noted otherwise.

20. Interlocking armored cables shall be as described previously in this section but shall also include an interlocking aluminum armor applied helically around the outside of the cable jacket. The interlocking armor may be left un-jacketed or may have a PVC outer jacket. The color of the armor jacket (if specified) shall match the jacket color of the optical fiber cable located inside of the armor. The armor for these cables shall be comparable to liquid tight flexible metal conduit if jacketed, or flexible metal conduit if not jacketed. Because of the interlocking metallic armor, this cable shall be listed OFCR. The interlocking armor and outer jacket options will be specified on the purchase order.

B. Connectors:

1. All multi-mode and single mode fiber optic cables shall be terminated via ceramic tipped, pre-polished field installed LC style connectors.

2. The connectors shall be a pull-proof design with an optical axial pull strength of 0.5lbf.

3. The maximum optical attenuation per each masted connector pair shall not exceed 0.75 dB.

4. The total optical attenuation through the cross-connect from any terminated optical fiber to any other terminated optical fiber shall not exceed 1.5 dB.

PART 3 – EXECUTION

3.01 ARRANGEMENT

A. Arrangement shall be consistent with the component locations and riser diagram shown on the drawings.

B. Precise as-built markups (illustrating actual field arrangements and component configurations) shall be submitted to the Engineer.

3.02 PREPARATION

A. Cable slack, service loops, bend radii, and pathway fill ratio shall comply with applicable codes and standards.

3.03 INSTALLATION

A. It is the intent of this specification that all cabling shall be the responsibility of this Contractor, including all terminations and cable system testing.

B. Concealed cable within partitions and penetrations through partitions or floors shall be installed in dedicated electrical metallic tubing with set screw type couplings and connectors.

C. Terminate cables according to manufacturer's instructions.

3.04 FIELD QUALITY CONTROL – TESTING

A. Testing procedures shall be in accordance with the following:

1. ANSI/TIA/EIA-568-A.
2. ANSI/TIA/EIA-568-B.1.
3. ANSI/TIA/EIA-526-7, Method B.
4. ANSI/TIA/EIA-526-14, Method B.
5. Proposed TSB-140 Tier One Fiber Certification (current draft).

B. Test equipment:

1. Optical power meter and source (Certification tester Fluke or Agilent preferred).

C. Testing:

1. All Multimode optical fibers shall be tested at both 850 nm and 1300 nm wave lengths for end-to-end insertion loss and Bi-Directional (MTR to TR-1, TR-1 to MTR).
2. All Single mode optical fibers shall be tested at both 1310 nm and 1550 nm wave lengths for end-to-end insertion loss and Bi-Directional (MTR to TR-1, TR-1 to MTR).

D. Completed test reports shall be submitted per contract requirements of Division 01 Section 01 33 19: Field Test Reporting.

3.05 LABELING

A. All backbone cables are to be labeled using a machine printed label at each end of the cable at approximately 12 inches of the termination point, and again at approximately 48 inches from the termination point. Handwritten labels shall not be used.

B. All wiring blocks, connector panels, or other termination points shall be labeled with the cable identifier as well as the pair or conductor identifier.

C. The labels shall denote, at a minimum, the starting and end points of the cable, as well as a unique cable identifier, i.e., FTO-A.FTO-B-1.

D. Note all labeling information on the as-built drawings.

END OF SECTION

SECTION 26 67 49

STRUT MOUNT CONTINUOUS CABLE SUPPORT SYSTEM

PART 1 – GENERAL

1.01 REQUIREMENTS

A. Furnish and install strut mount continuous cable support system above accessible ceiling systems only in accordance with the parameters shown on the drawings and herein specified.

B. System shall include u-hooks, double j-hooks, swivel brackets, rollers, wire retainers, protection tubes, wall brackets, threaded rods, etc. and all accessories necessary for a complete system.

C. Systems shall conform with the applicable portions of American National Standards Institute (ANSI), Telecommunications Industry Association (TIA), Electronic Industries Alliance (EIA), Telecommunications Distribution Methods Manual, 14th Edition and Building Industry Consulting Services International (BICSI).

D. Systems shall conform with the applicable portions of the requirements set forth in the National Electrical Code (NFPA-70, 2020 Edition).

PART 2 – PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. NVENT Caddy CAT-CM Cable Support System, or approved equal.

2.02 DESCRIPTION

A. Strut Mount Continuous Cable Support System U-hooks (CAT200CMLN):

1. U-hooks shall be electrogalvanized steel.

2. The system shall offer optional rollers and retainers for use on U-hooks to retain cables and support cable pulls.

3. U-hooks shall have a pre-assembled quick attachment nut for mounting to half-slot strut.

4. U-hooks shall be able to utilize readily available half-slot strut.

5. U-hooks shall allow for customized support spacing.

6. Shall have steel transition pieces for elevation and directional changes.

7. Shall have protective tubes for threaded rod to eliminate scraping and cutting of cable sheath during pulling.

8. U-hooks shall be compliant with NEC and ANSI/TIA structured cabling systems standards.

B. Strut Mount Continuous Cable Support System Double J-hook (CAT100CM):

1. Double J-hooks shall be electrogalvanized steel.

2. The system shall offer retainers for use on Double J-hooks to retain cables.

3. Double J-hooks shall be able to utilize readily available half-slot strut.

4. Double J-hooks shall allow for customized support spacing.

5. Double J-hooks shall be compliant with NEC and ANSI/TIA structured cabling systems standards.

PART 3 – EXECUTION

3.01 INSTALLATION

A. System shall be installed per manufacturer's installation instructions. System shall be installed above accessible ceiling systems only, all others areas shall require a conduit system.

B. Attach to support structure or sub structure using threaded rods placed at a maximum distance of 5' apart. Installer is responsible for the integrity of the structures to which the system is attached, including their capability of safely accepting the loads imposed as evaluated by a qualified engineer.

C. Support pathway from building support structure or sub structure. Do not support pathway from ductwork, piping, or other equipment hangers.

D. Coordinate all pathway runs with other trades prior to installation.

E. All pathways shall be installed a minimum of 12 in. away from any light fixture or other source of EMI (Electro-magnetic interference).

F. Horizontal pathways shall be sized for a minimum of 50% future growth.

G. Load Strut Mount U-hooks evenly.

H. Install cables using techniques, practices, and methods that are consistent with cable manufacturer's recommendations.

END OF SECTION

SECTION 26 67 92

EMERGENCY PHONE TOWER SYSTEM

PART 1 – GENERAL

1.01 REQUIREMENTS

A. Furnish and install emergency phone tower systems in accordance with the parameters shown on the drawings and herein specified.

B. System shall be Underwriters Laboratories listed, Federal Communications Commission (FCC) and Americans With Disabilities Act (ADA) compliant; complete with freestanding tower enclosure, hands-free emergency phone, consolidator, lights, hardware and all appliances.

C. Refer to Section 266010, General Provisions, for requirements relative to submittals, accessories and components, installation, removals, protection, maintenance manual, systems demonstration and instruction.

1.02 SOURCE AND SERVICE

A. Source:

1. Basic systems components and associated accessories shall be furnished by a single representative and factory authorized equipment distributor.

1.03 GUARANTEE

A. The system shall be guaranteed to be free from defects in materials and workmanship for a period of 2 years from the date of final acceptance by the Owner, during which time all above mentioned defects shall be corrected and all services incidental to proper performance shall be provided free of charge.

1.04 FABRICATION DRAWINGS, MATERIAL LISTS AND EQUIPMENT SUBMITTALS

A. Descriptive literature for system components.

B. Material lists for system distribution (wire, cables, boxes, support, etc.).

C. Wiring diagrams for component connections.

D. Description of operation.

PART 2 – PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Talkaphone or approved equal.

2.02 DESCRIPTION

A. Freestanding tower enclosure:

1. Tower:

a. 0.25” thick steel.

b. High-gloss, multi-coat corrosion–inhibitive coating.

c. High-gloss, multi-coat, corrosion-inhibitive coating:

1) Sandblasted to SSPC-6 standards before a 2-3 mil layer of rust-inhibitive primer is applied.

2) Hand sanded for smoothness before a second 2-3 mil layer of primer is applied.

3) 2-3 mil layer of customer specified color coat applied.

4) 1-2 mil layer of clear coat applied.

2. Tower base plate:

a. 2.0” above the tower base.

b. Constructed of 0.75” thick A-36 Structural Steel.

c. 4” diameter center hole for wiring access.

d. Four 1” holes for anchor bolt attachment.

3. Tower wiring access opening:

a. Measure 9” high x 6.75” wide mounted 15” above base of tower.

b. 0.25” thick steel flush cover plate, secured by tamper-resistant spanner screws.

B. Hands-free emergency phone:

1. General:

a. Outdoor-rated, vandal resistant and ADA-compliant hands-free speakerphone communications device.

b. One red anodized aluminum tactile button labeled “EMERGENCY” and one 0.375” diameter red light emitting diode (LED) labeled “LIGHT ON IDICATES CALL RECEIVED”.

c. Programmable from a remote location and have a two number dialing capability, reverting to the second number if the first is busy or does not respond. Totally hands-free operation on both sides after connection is initiated at site or by attendant. Phone line powered, requiring no outside power source or battery back-up dedicated communication line.

2. Construction:

   a. Chassis and face plate shall be constructed of stainless steel.

   b. Signage shall be constructed of cast metal with lettering and Braille raised approximately 3/32" for ADA compliance. Word "EMERGENCY" and button shall be red.

   c. Push button and switch shall be a single assembly rated for 1,000,000 cycles.

   d. Speaker and microphone shall be protected by non-ferrous metal screen to provide a barrier against vandalism, rain and snow.

3. Features:

   a. Capable of operating on standard phone lines or analog PBX extensions.

   b. Dial at approximately 10 tones per second.

   c. Output sound level shall be greater than 80 dB at one meter for normal conversation.

   d. All programming shall be stored in non-volatile EEPROM memory.

   e. Button shall provide tactile feedback.

   f. Programmable from a remote telephone via keypad entry.

   g. Call timer shall be programmable from 1 to 4320 minutes.

   h. LED for the hearing impaired shall illuminate to indicate when calling party may speak (when receiving party is silent).

   i. Programmable with two different telephone numbers of up to 18 digits each including pauses. If first number does not answer or is busy, unit shall automatically call the second number. If that number is busy or does not answer, unit shall call the first number again. Unit shall continue alternating until call is answered or call timer limit is reached.

   j. When dialing a secondary number, unit shall be capable of hanging up for a minimum 2.25 seconds to avoid triggering a hook-flash.

   k. Unit shall include two auxiliary outputs and one auxiliary input that are opto-isolated from the telephone line to 1,000 volts. Outputs shall be activated, providing a dry contact closure, either automatically when Emergency Phone is activated or manually by guard keypad operation. Input shall allow unit to be activated by any device or switch that provides a contact closure. Input shall require battery kit, ETP-AUXIN-KIT to activate.

   l. Incoming and outgoing volume shall be adjustable separately.

   m. Capable of automatically notifying attendant of location via programmable 6 digit ID.

n. Capable of silent monitoring.

o. Utilize tone dialing.

p. When call is finished, unit shall automatically shut off.

q. Answer any call placed to it from any other telephone.

r. Two levels of programmable passwords shall be available.

s. Varistor lightening suppressed and full wave polarity guarded.

t. Parallel tip and ring connected to an RJ-11 connector for quick installation.

4. Environmental:

a. 3.5 inch waterproof speaker with a vinyl-impregnated cloth cone. Magnet and solid aluminum voice coil area shall be protected from ferrous and non-ferrous particles by a special sealed design. The speaker shall be capable of operating without deterioration of sound quality after total immersion in water for 96 hours. Speaker shall operate at temperatures of -55ºC to +85ºC. Steel basket shall have a zinc dichromate finish for protection against corrosion.

b. Water-resistant microphone assembly.

c. Push button/wwitch shall be a single assembly. Epoxy seals shall protect contacts and terminals from hostile environments and solder flux. Unit shall be waterproof and submergible to 3 feet in water. Unit shall have a mechanical life of 1,000,000 cycles. Case shall be moisture-proof, dust-tight and designed to accommodate the high shock military specifications of MIL-STD-202, method 207. Case shall be aluminum alloy, anodized clear. Button shall be aluminum painted UV-resistant red or black. Switch shall be rated to operate from -55ºC to +80ºC.

d. PC boards and other electronic components shall withstand a corrosive atmosphere of 90% H_2S for 16 hours. PC boards shall be rated R4. Unit shall be designed to operate at temperatures from 20ºC to +65ºC and humidity levels up to 95% relative humidity at 49ºC.

e. Protective Sealing of Completed PC Boards: Once the unit has been wave soldered and inspected and the completed boards tested, the entire circuit board apparatus shall be conformably coated by dipping rather than spraying (Mil-I416058C amend 6). The microprocessor chip shall then be installed in its socket and sealed in place with a special electrical grade RTV type sealant. At this point the boards can be sprayed with water without affecting the operation of the unit.

5. Electrical:

a. Fully phone line powered, requiring no external power or battery back-up.

b. One dedicated, twisted communication pair shall provide a minimum of 24VDC and 20mA while off hook.

6. Mounting:

a. Six vandal-resistant, oval-head, undercut spanner mounting screws to mount flush into Talk-A-Phone flush mounting sleeves, free-standing Tower Mounts, Pedestal Mounts, Surface Mount Accessories and Wall Mounts.

C. Consolidator:

1. General:

a. Allow up to 8 individually addressable Emergency Phones to utilize one phone line without reduction in volume with line seizure capability to allow phone line to be shared.

b. Create an internal communication system without need for phone lines by using a standard analog phone. The unit shall provide visual indication of calling location and auxiliary outputs to allow for activating devices when a call is received. Unit shall function as an internal system with external calling capability as an automatic back up.

2. Construction:

a. 11 RJ11 modular phone ports for connecting 8 ARA stations, a local phone, a telco line in and a telco line out.

3. Features:

a. When call button is pushed on an Emergency Phone, Consolidator shall automatically give the line to that Emergency Phone.

b. When call button is pushed on second Emergency Phone while first is active, second shall be queued and call shall be placed as soon as first call is completed.

c. Unit shall permit phone line to be shared with another device. Line seizure capability shall allow unit to give line to an Emergency Phone when phone is activated.

d. Built-in LEDs to indicate identity of calling Emergency Phone.

e. Permit selective calling of all Emergency Phones.

f. Allow connection of a standard telephone to create an internal communication system. No phone lines shall be needed for on-site calling.

g. Capable of routing emergency calls to local phone and telco line alternately until call is connected. Primary method (local or telco) and number of rings before switching to alternate calling method shall be determined by software programming.

h. Remotely programmable through telco line and also programmable on-site through local phone. Programming shall be stored in non-volatile EEPROM memory.

i. Two built-in auxiliary outputs: one for activating devices when Consolidator receives call and when for when call is answered.

4. Lighting:

a. One LED for each of 8 Emergency Phone ports. When an Emergency Phone call is in progress but not connected the LED shall blink. When the Emergency Phone call has been connected, the LED shall light solidly. When one Emergency Phone is active and secondary Emergency Phones are activated, the LEDs for those secondary Emergency Phones shall blink.

b. Four separate LEDs to indicate: system power, telco line in use, telco line ringing, and local phone off-hook.

5. Electrical:

a. UL Listed power supply requiring 0.8 Amps, 100-240VAC, 50-60Hz with an output of 1.0 Amps at 24VDC.

b. Resistance of wire connecting Emergency Phone and Consolidator should not exceed 25 ohms.

6. Mounting:

a. Include keyhole slots to mount to a wall or may sit on a desktop.

PART 3 – EXECUTION

3.01 SYSTEM ARRANGEMENT

A. Precise as-built mark-ups (illustrating actual field wiring arrangements and equipment configurations) shall be submitted to the Engineer.

3.02 INSTALLATION

A. Properly support system devices in a rigid, secure fashion.

3.03 SUPERVISION AND TESTING

A. General:

1. Supervision and testing shall be executed by an authorized manufacturer's representative.

B. Supervision:

1. Provide on-site observation throughout the system construction period, lending all guidance necessary to insure a proper installation.

2. Perform the prescribed "systems demonstration" and "instruction".

C. Testing:

1. Instrumentation for testing shall be state-of-the-art, professional quality, properly calibrated, in excellent condition and fully capable of addressing the associated system parameters.

2. Perform testing in a thorough, well organized fashion, complete with all adjustments necessary to achieve the specified system parameters.

3. Record:

a. Technician's name and test date(s).

b. Model number, serial number and location for each system component.

c. All specified parameters and associated test results, including adjustment set points.

3.04 INSTRUCTION

A. Provide thorough demonstrative instruction (2-hour session) via authorized technicians; secure Owner's written acknowledgement and submit to Engineer.

END OF SECTION

SECTION 26 69 40

DISTRIBUTED DIGITAL LIGHTING CONTROL SYSTEM

PART 1 – GENERAL

1.01 REQUIREMENTS

A. Furnish and install distributed digital lighting control system in accordance with the parameters shown on the drawings and herein specified.

1.02 SOURCE AND SERVICE

A. Source:

1. Basic systems components and associated accessories shall be furnished by a single manufacturer through a factory authorized distributor.

B. Service:

1. Systems service shall be available from the manufacturer's authorized distributor 24 hours of every day via qualified factory trained technicians.

1.03 GUARANTEE

A. The system shall be guaranteed to be free from defects in materials and workmanship for a period of 5 years from the date of final acceptance by the Owner, during which time all above mentioned defects shall be corrected and all services incidental to proper performance shall be provided free of charge.

1.04 FABRICATION DRAWINGS, MATERIAL LISTS AND EQUIPMENT SUBMITTALS

A. Descriptive literature for system components.

B. Material lists for system distribution (wire, cables, boxes, support, etc.).

C. Wiring diagrams for component connections.

1.05 SYSTEM DESCRIPTION & OPERATION

A. The Lighting Control and Automation system as defined under this section covers the following equipment

1. Digital Lighting Management (DLM) local network – Free topology, plug-in wiring system (Cat 5e) for power and data to room devices.

2. Digital Room Controllers – Self-configuring, digitally addressable one, two or three relay plenum-rated controllers for on/off control. Selected models include 0-10 volt or line voltage forward phase control dimming outputs and integral current monitoring capabilities.

3. Digital Fixture Controllers – Self-configuring, digitally addressable one relay fixture-integrated controllers for on/off/0-10V dimming control.

4. Digital Occupancy Sensors – Self-configuring, digitally addressable, calibrated occupancy sensors with LCD display and two-way active infrared (IR) communications.

5. Digital Switches – Self-configuring, digitally addressable pushbutton on/off, dimming, and scene switches with two-way active infrared (IR) communications.

6. Handheld remotes for personal control – On/Off, dimming and scene remotes for control using infrared (IR) communications. Remote may be configured in the field to control selected loads or scenes without special tools.

7. Configuration Tools – Handheld remote for room configuration and relay panel programming provides two-way infrared (IR) communications to digital devices and allows complete configuration and reconfiguration of the device / room from up to 30 feet away.

8. Digital Lighting Management (DLM) segment network – Linear topology, BACnet MS/TP network (1.5 twisted pair, shielded) to connect multiple DLM local networks for centralized control.

9. Programming and Configuration Software – Optional PC-native application capable of accessing DLM control parameters within a room, for the local network, via a USB adapter, or globally, for many segment networks simultaneously, via BACnet/IP communication.

10. Emergency Lighting Control Unit (ELCU) – Allows a standard lighting control device to control emergency lighting in conjunction with normal lighting in any area within a building.

PART 2 – PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Watt Stopper or approved equal.

2.02 DESCRIPTION

A. DLM Local Network (Room Network)

1. The DLM local network is a free topology lighting control physical connection and communication protocol designed to control a small area of a building.

2. Features of the DLM local network include:

a. Plug n' Go automatic configuration and binding of occupancy sensors, switches and lighting loads to the most energy-efficient sequence of operation based upon the device attached.

b. Simple replacement of any device in the local DLM network with a standard off the shelf unit without requiring significant commissioning, configuration or set up.

c. Push n' Learn configuration to change the automatic configuration, including binding and load parameters without tools, using only the buttons on the digital devices in the local network.

d. Two-way infrared communications for control by handheld remotes, and configuration by a handheld tool including adjusting load parameters, sensor configuration and binding, within a line of sight of up to 30 feet from a sensor, wall switch or IR receiver.

3. Digital room devices connect to the local network using pre-terminated Cat 5e cables with RJ-45 connectors, which provide both data and power to room devices. Systems that utilize RJ-45 patch cords but do not provide serial communication data from individual end devices are not acceptable.

4. If manufacturer's pre-terminated Cat5e cables are not used for the installation, the contractor is responsible for testing each cable following installation and supplying manufacturer with test results.

5. WattStopper product number: LMRJ-Series.

B. Digital Load Controllers (Room, Plug Load And Fixture Controllers):

1. Digital controllers for lighting and plug loads automatically bind the room loads to the connected devices in the space without commissioning or the use of any tools. Room and plug load controllers shall be provided to match the room lighting and plug load control requirements. The controllers will be simple to install, and will not have dip switches or potentiometers, or require special configuration for standard Plug n' Go applications. The control units will include the following:

a. Automatic room configuration to the most energy-efficient sequence of operation based upon the devices in the room.

b. Simple replacement – Using the default automatic configuration capabilities, a room controller may be replaced with an off-the-shelf.

c. Multiple room controllers connected together in a local network must automatically arbitrate with each other, without requiring any configuration or setup, so that individual load numbers are sequentially assigned using each controller's device ID's from highest to lowest.

d. Device Status LEDs to indicate:

1) Data transmission.

2) Device has power.

3) Status for each load.

4) Configuration status.

e. Quick installation features including:

1) Standard Junction Box mounting.

2) Quick low voltage connections using standard RJ-45 patch cable.

f. Based on individual configuration, each load shall be capable of the following behavior on power up following the loss of normal power:

1) Turn on to 100%.

2) Turn off.

3) Turn on to last level.

g. Each load shall at a minimum be configurable to operate in the following sequences based on occupancy:

1) Auto-on/Auto-off (Follow on and off).

2) Manual-on/Auto-off (Follow off only).

h. The polarity of each load output shall be reversible, via digital configuration, so that on is off and off is on.

i. BACnet object information shall be available for the following objects:

1) Load status.

2) Electrical current (when available).

3) Total watts per controller.

4) Schedule state – normal or after-hours.

5) Demand response enable and disable.

6) Room occupancy status.

7) Total room lighting and plug loads watts.

8) Total room watts/sq ft.

9) Force on/off all loads.

j. UL 2043 plenum rated.

k. Manual override and LED indication for each load.

l. Dual voltage (120/277 VAC, 60 Hz), or 347 VAC, 60 Hz (selected models only). 120/277-volt models rated for 20A total load, derating to 16A required for some dimmed loads (forward phase dimming); 347-volt models rated for 15A total load; plug load controllers carry application-specific UL 20 rating for receptacle control.

m. Zero cross circuitry for each load.

n. All digital parameter data programmed into an individual room controller or plug load controller shall be retained in non-volatile FLASH memory within the controller itself. Memory shall have an expected life of no less than 10 years.

2. On/Off Room Controllers shall include:

a. One or two relay configuration.

b. Efficient 150 mA switching power supply.

c. Three RJ-45 DLM local network ports with integral strain relief and dust cover.

d. WattStopper product numbers: LMRC-101, LMRC-120.

3. On/Off/Dimming enhanced Room Controllers shall include:

a. Real time current monitoring.

b. Multiple relay configurations.
1) One, two or three relays (LMRC-21x series).

2) One or two relays (LMRC-22x series).

c. Efficient 250 mA switching power supply.

d. Four RJ-45 DLM local network ports with integral strain relief and dust cover.

e. One dimming output per relay.

1) 0-10V Dimming - Where indicated, one 0-10-volt analog output per relay for control of compatible ballasts and LED drivers. The 0-10-volt output shall automatically open upon loss of power to the Room Controller to assure full light output from the controlled lighting. (LMRC-21x series).

2) Line Voltage, Forward Phase Dimming - Where indicated, one forward phase control line voltage dimming output per relay for control of compatible two-wire or three-wire ballasts, LED drivers, MLV, forward phase compatible ELV, neon/cold cathode and

incandescent loads. (LMRC-22x series).

3) Each dimming output channel shall have an independently configurable minimum and maximum calibration trim level to set the dimming range to match the true dynamic range of the connected ballast or driver.

4) The LED level indicators on bound dimming switches shall utilize this new maximum and minimum trim.

5) Each dimming output channel shall have an independently configurable minimum and maximum trim level to set the dynamic range of the output within the new 0-100% dimming range defined by the minimum and maximum calibration trim.

6) Calibration and trim levels must be set per output channel.

7) Devices that set calibration or trim levels per controller are not acceptable.

8) All configuration shall be digital. Devices that set calibration or trim levels per output channel via trim pots or dip-switches are not acceptable.

f. Each load shall have an independently configurable preset on level for Normal Hours and After-Hours events to allow different dimmed levels to be established at the start of both Normal Hours and After-Hours events.

g. Fade rates for dimming loads shall be specific to bound switch buttons, and the load shall maintain a default value for any bound buttons that do not specify a unique value.

h. The following dimming attributes may be changed or selected using a wireless configuration tool:

1) Establish preset level for each load from 0-100%.

2) Set high and low trim for each load.

3) Set lamp burn in time for each load up to 100 hours.

i. Override button for each load provides the following functions:

1) Press and release for on/off control.

2) Press and hold for dimming control.

J. WattStopper product numbers: LMRC-211, LRMC-212, LRMC-213, LMRC-221, LMRC-222.

4. Fixture Controllers shall include:

a. A form factor and product ratings to allow various OEM fixture manufacturers to mount the device inside the ballast/driver cavity of standard-sized fluorescent or LED general lighting fixtures.

b. One 3A 120/277V rated mechanically held relay.

c. Programmable behavior on power up following the loss of normal power:

1) Turn on to 100%.

2) Turn off.

3) Turn on to last level.

d. Requirement for 7 mA of 24VDC operating power from the DLM local network.

1) The Fixture Controller does not require a connection to a neutral conductor to operate, and unlike other types of Load Controllers it does not contribute power to the DLM local network to drive accessory devices.

2) Power to drive the LMFC Fixture Controller electronics can come from any Room or Plug Load Controller, LMPB-100 Power Booster and/or LMZC-301 Zone Controller (described later in the LMCP LIGHTING CONTROL PANELS specification section).

e. 0-10V dimming capability via a single 0-10-volt analog output from the device for control of compatible ballasts and LED drivers. The 0-10-volt output shall automatically open upon loss of power to the Fixture Controller.

f. Terminals to connect an RJ-45 adaptor with 24" leads, mountable in a ½" KO, for connection to the DLM local network:

1) The adaptor leads are insulated for use in a fixture cavity, and the lead length allows the OEM fixture manufacturer flexibility to position the Fixture Controller and the RJ45 jack in the best locations on each fixture.

g. A complete set of dimming features described above in the section detailing On/Off/Dimming Enhanced Room Controllers (subsection C.5 onward).

h. WattStopper product numbers: Fixture Controller: LMFC-011, DLM Cable Connector: LMFC-RJ-50-24, Power Booster: LMPB-100.

C. Digital Wall or Ceiling Mounted Occupancy Sensor:

1. Wall or ceiling mounted (to suit installation) passive infrared (PIR), ultrasonic or dual technology digital (passive infrared and ultrasonic) occupancy sensor.

2. Digital Occupancy Sensors shall provide graphic LCD display for digital calibration and electronic documentation. Features include the following:

   a. Digital calibration and pushbutton configuration for the following variables:

      1) Sensitivity – 0-100% in 10% increments.

      2) Time delay – 1-30 minutes in 1-minute increments.

      3) Test mode – Five second time delay.

      4) Detection technology – PIR, Ultrasonic or Dual Technology activation and/or re-activation.

      5) Walk-through mode.

   b. Load parameters including Auto/Manual-ON, blink warning, and daylight enable/disable when photosensors are included in the DLM local network.

   c. Programmable control functionality including:

      1) Each sensor may be programmed to control specific loads within a local network.

      2) Sensor shall be capable of activating one of 16 user-definable lighting scenes.

      3) Adjustable retrigger time period for manual-on loads. Load will retrigger (turn on) automatically within a configurable period of time (default 10 seconds) after turning off.

      4) On dual technology sensors, independently configurable trigger modes are available for both Normal (NH) and After Hours (AH) time periods. The retrigger mode can be programmed to use the following technologies.

         a. Ultrasonic and Passive Infrared.

         b. Ultrasonic or Passive Infrared.

         c. Ultrasonic only.

         d. Passive Infrared only.

   d. Independently configurable sensitivity settings for passive infrared and ultrasonic technologies (on dual technology sensors) for both Normal (NH) and After Hour (AH) time periods.

   e. One or two RJ-45 port(s) for connection to DLM local network.

f. Two-way infrared (IR) transceiver to allow remote programming through handheld commissioning tool and control by remote personal controls.

g. Device Status LEDs, which may be disabled for selected applications, including:

1) PIR detection

2) Ultrasonic detection

3) Configuration mode

4) Load binding

h. Assignment of occupancy sensor to a specific load within the room without wiring or special tools.

i. Manual override of controlled loads.

j. All digital parameter data programmed into an individual occupancy sensor shall be retained in non-volatile FLASH memory within the sensor itself. Memory shall have an expected life of no less than 10 years.

3. BACnet object information shall be available for the following objects:

a. Detection state

b. Occupancy sensor time delay

4. Occupancy sensor sensitivity, PIR and Ultrasonic

Units shall not have any dip switches or potentiometers for field settings.

5. Multiple occupancy sensors may be installed in a room by simply connecting them to the free topology DLM local network. No additional configuration will be required.

6. WattStopper product numbers: LMPX, LMDX, LMPC, LMUC, LMDC

D. Digital Wall Switch Occupancy Sensors:

1. Wallbox mounted passive infrared PIR or dual technology (passive infrared and ultrasonic) digital occupancy sensor with 1 or 2 switch buttons.

2. Digital Occupancy Sensors shall provide scrolling LCD display for digital calibration and electronic documentation. Features include the following:

a. Digital calibration and pushbutton configuration for the following variables:

1) Sensitivity – 0-100% in 10% increments

2) Time delay – 1-30 minutes in 1-minute increments

3) Test mode – Five second time delay

4) Detection technology – PIR, Dual Technology activation and/or re-activation

5) Walk-through mode

6) Load parameters including Auto/Manual-ON, blink warning, and daylight enable/disable when photosensors are included in the DLM local network

b. Programmable control functionality including:

1) Each sensor may be programmed to control specific loads within a local network.

2) Sensor shall be capable of activating one of 16 user-definable lighting scenes.

3) Adjustable retrigger time period for manual-on loads. Load will retrigger (turn on) automatically during the configurable period of time (default 10 seconds) after turning off.

4) On dual technology sensors, independently configurable trigger modes are available for both Normal (NH) and After Hours (AH) time periods. The retrigger mode can be programmed to use the following technologies:

a. Ultrasonic and Passive Infrared

b. Ultrasonic or Passive Infrared

c. Ultrasonic only

d. Passive Infrared only

c. Independently configurable sensitivity settings for passive infrared and ultrasonic technologies (on dual technology sensors) for both Normal (NH) and After Hour (AH) time periods.

d. Two RJ-45 ports for connection to DLM local network.

e. Two-way infrared (IR) transceiver to allow remote programming through handheld configuration tool and control by remote personal controls.

f. Device Status LEDs including

a. PIR detection

b. Ultrasonic detection

c. Configuration mode

d. Load binding

g. Assignment of any occupancy sensor to a specific load within the room without wiring or special tools.

h. Assignment of local buttons to specific loads within the room without wiring or special tools.

i. Manual override of controlled loads.

j. All digital parameter data programmed into an individual wall switch sensor shall be retained in non-volatile FLASH memory within the wall switch sensor itself. Memory shall have an expected life of no less than 10 years.

3. BACnet object information shall be available for the following objects:

a. Detection state

b. Occupancy sensor time delay

c. Occupancy sensor sensitivity, PIR and Ultrasonic

d. Button state

e. Switch lock control

f. Switch lock status

4. Units shall not have any dip switches or potentiometers for field settings.

5. Multiple occupancy sensors may be installed in a room by simply connecting them to the free topology DLM local network. No additional configuration will be required.

6. Two-button wall switch occupancy sensors, when connected to a single relay dimming room or fixture controller, shall operate in the following sequence as a factory default:

a. Left button

1) Press and release - Turn load on.

2) Press and hold - Raise dimming load.

b. Right button

1) Press and release - Turn load off.

3) Press and hold - Lower dimming load.

7. Low voltage momentary pushbuttons shall include the following features:

a. Load/Scene Status LED on each switch button with the following characteristics:

1) Bi-level LED

2) Dim locator level indicates power to switch

3) Bright status level indicates that load or scene is active

b. The following button attributes may be changed or selected using a wireless configuration tool:

1) Load and Scene button function may be reconfigured for individual buttons (from Load to Scene, and vice versa).

2) Individual button function may be configured to Toggle, On only or Off only.

3) Individual scenes may be locked to prevent unauthorized change.

4) Fade Up and Fade Down times for individual scenes may be adjusted from 0 seconds to 18 hours.

5) Ramp rate may be adjusted for each dimmer switch.

6) Switch buttons may be bound to any load on any load controller or relay panel and are not load type dependent; each button may be bound to multiple loads.

7) WattStopper part numbers: LMPW, LMDW. Available in white, light almond, ivory, grey, red and black; compatible with wall plates with decorator opening.

E. Digital wall switches

1. Low voltage momentary pushbutton switches in 1, 2, 3, 4, 5 and 8 button configurations. Wall switches shall include the following features

a. Two-way infrared (IR) transceiver for use with personal and configuration remote controls.

b. Removable buttons for field replacement with engraved buttons and/or alternate color buttons. Button replacement may be completed without removing the switch from the wall.

c. Configuration LED on each switch that blinks to indicate data transmission.

d. Load/Scene Status LED on each switch button with the following characteristics:

1) Bi-level LED

2) Dim locator level indicates power to switch

3) Bright status level indicates that load or scene is active

4) Dimming switches shall include seven bi-level LEDs to indicate load levels using 14 steps.

e. Programmable control functionality including:

1) Button priority may be configured to any BACnet priority level, from 1-16, corresponding to networked operation allowing local actions to utilize life safety priority

2) Scene patterns may be saved to any button other than dimming rockers. Once set, buttons may be digitally locked to prevent overwriting of the preset levels.

f. All digital parameter data programmed into an individual wall switch shall be retained in non-volatile FLASH memory within the wall switch itself. Memory shall have an expected life of no less than 10 years.

2. BACnet object information shall be available for the following objects:

a. Button state

b. Switch lock control

c. Switch lock status

3. Two RJ-45 ports for connection to DLM local network.

4. Multiple digital wall switches may be installed in a room by simply connecting them to the free topology DLM local network. No additional configuration shall be required to achieve multi-way switching.

5. The following switch attributes may be changed or selected using a wireless configuration tool.

6. Load and Scene button function may be reconfigured for individual buttons (from Load to Scene, and vice versa).

    a. Individual button function may be configured to Toggle, On only or Off only.

    b. Individual scenes may be locked to prevent unauthorized change.

    c. Fade Up and Fade Down times for individual scenes may be adjusted from 0 seconds to 18 hours.

    d. Ramp rate may be adjusted for each dimmer switch.

    e. Switch buttons may be bound to any load on any load controller or relay panel and are not load type dependant; each button may be bound to multiple loads.

    f. WattStopper product numbers: LMSW-101, LMSW-102, LMSW-103, LMSW-104, LMSW-105, LMSW-108, LMDM-101. Available in white, light almond, ivory, grey, red and black; compatible with wall plates with decorator opening.

F. Room controllers:

1. Room Controllers automatically bind the room loads to the connected devices in the space without commissioning or the use of any tools. The control units will include the following features:

    a. Automatic room configuration to the most energy-efficient sequence of operation based upon the devices in the room.

    b. Simple replacement – Using the default automatic configuration capabilities, a room controller may be replaced with an off-the-shelf unit without requiring any configuration or setup.

    c. Device Status LEDs to indicate:

        1) Data transmission.

        2) Device has power.

        3) Status for each load.

        4) Configuration status.

    d. Quick installation features including:

        1) Standard junction box mounting.

        2) Quick low voltage connections using standard RJ-45 patch cable.

e. Plenum rated.

f. Manual override and LED indication for each load.

g. Dual voltage (120/277 VAC, 60 Hz).

h. Zero cross circuitry for each load.

2. On/Off Room Controllers shall include:

a. One or two relay configurations.

b. Efficient 150 mA switching power supply.

c. Three RJ-45 DLM local network ports.

d. Discrete model listed for connection to receptacles, for occupancy-based control of plug loads within the space.

1) One relay configuration only.

2) Automatic-ON/OFF configuration.

e. WattStopper Model Numbers: LMRC-101, LMRC-102, LMPL-101.

3. On/Off/Dimming enhanced Room Controllers shall include:

a. Real time current monitoring.

b. One, two or three relay configurations.

c. Efficient 250 mA switching power supply.

d. Four RJ-45 DLM local network ports.

e. One 0-10-volt analog output per relay for control of compatible ballasts and LED drivers.

f. Optional Network Bridge for BACnet MS/TP communications (LMRC-3xx).

g. The following dimming attributes may be changed or selected using a wireless configuration tool:

1) Establish preset level for each load from 0-100%.

2) Set high and low trim for each load.

3) Set lamp burn in time for each load up to 100 hours.

h. Discrete model listed for connection to receptacles, for occupancy-based control of plug loads within the space.

1) One relay configuration only.

2) Automatic-ON/OFF configuration.

i. WattStopper Model Numbers: LMRC-211, LRMC-212, LRMC-213, LMPL-201, LMRC-311, LMRC-312, LMRC-313.

G. DLM Handheld User Interface Remotes:

1. Battery-operated handheld devices in 1, 2 and 5 button configurations for remote switching or dimming control. Remote controls shall include the following features:

a. Two-way infrared (IR) transceiver for line of sight communication with DLM local network within up to 30 feet.

b. LED on each button confirms button press.

c. Load buttons may be bound to any load on a load controller or relay panel and are not load type dependant; each button may be bound to multiple loads.

d. Inactivity timeout to save battery life.

2. A wall mount holster and mounting hardware shall be included with each remote control

3. WattStopper part numbers: LMRH-101, LMRH-102, LMRH-105.

H. Handheld and Computer Configuration Tools:

1. A wireless configuration tool facilitates optional customization of DLM local networks using two-way infrared communications, while PC software connects to each local network via a USB interface.

2. Features and functionality of the wireless configuration tool shall include but not be limited to:

a. Two-way infrared (IR) communication with DLM IR-enabled devices within a range of approximately 30 feet.

b. High visibility organic LED (OLED) display, pushbutton user interface and menu-driven operation.

c. Must be able to read and modify parameters for load controllers and relay panels, occupancy sensors, wall switches, daylighting sensors, network bridges, and identify DLM devices by type and serial number.

d. Save up to eight occupancy sensor setting profiles, and apply profiles to selected sensors.

e. Temporarily adjust light level of any load(s) on the local network, and incorporate those levels in scene setting. Set room mode for testing of Normal Hours (NH) and After Hours (AH) parameter settings.

f. Adjust or fine-tune daylighting settings established during auto-configuration, and input light level data to complete configuration of open loop daylighting controls.

g. Set room mode for testing of Normal Hours (NH) and After Hours (AH) parameter settings.

h. Verify status of building level network devices.

3. WattStopper Product Numbers: LMCT-100, LMCI-100/LMCS-100

I. Programming, Configuration and Documentation Software:

a. PC-native application for optional programming of detailed technician-level parameter information for all DLM products, including all parameters not accessible via BACnet and the handled IR configuration tool. Software must be capable of accessing room-level parameter information locally within the room when connected via the optional LMCI-100 USB programming adapter, or globally for many segment networks simultaneously utilizing standard BACnet/IP communication.

b. Additional parameters exposed through this method include but are not limited to:

1) Occupancy sensor detection LED disable for performance and other aesthetic spaces where blinking LEDs present a distraction.

2) Six occupancy sensor action behaviors for each controlled load, separately configurable for normal hours and after-hours modes. Modes include: No Action, Follow Off Only, Follow On Only, Follow On and Off, Follow On Only with Override Time Delay, Follow Off Only with Blink Warn Grace Time, Follow On and Off with Blink Warn Grace Time.

3) Separate fade time adjustments per load for both normal and after hours from 0 - 4 hours.

4) Configurable occupancy sensor re-trigger grace period from 0 - 4 minutes separate for both normal hours and after hours.

5) Separate normal hours and after hours per-load button mode with modes including: Do nothing, on only, off only, on and off.

6) Load control polarity reversal so that on events turn loads off and vice versa.

7) Per-load DR (demand response) shed level in units of percent.

8) Load output pulse mode in increments of 1second.

9) Fade trip point for each load for normal hours and after hours that establishes the dimmer command level at which a switched load closes its relay to allow for staggered on of switched loads in response to a dimmer.

c. Generation of reports at the whole file, partial file, or room level. Reports include but are not limited to:

1) Device list report: All devices in a project listed by type.

2) Load binding report: All load controller bindings showing interaction with sensors, switches, and daylighting.

3) BACnet points report: Per room Device ID report of the valid BACnet points for a given site's BOM.

4) Room summary report: Device manifest for each room, aggregated by common BOM, showing basic sequence of operations.

5) Device parameter report: Per-room lists of all configured parameters accessible via hand held IR programmer for use with O&M documentation.

6) Scene report: All project scene pattern values not left at defaults (i.e. 1 = all loads 100%, 2 = all loads 75%, 3 = all loads 50%, 4 = all loads 25%, 5-16 = same as scene 1).

7) Occupancy sensor report: Basic settings including time delay and sensitivity(ies) for all occupancy sensors.

d. Network-wide programming of parameter data in a spreadsheet-like programming environment including but not limited to the following operations:

1) Set, copy/paste an entire project site of sensor time delays.

2) Set, copy/paste an entire project site of sensor sensitivity settings.

3) Search based on room name and text labels.

4) Filter by product type (i.e. LMRC-212) to allow parameter set by product.

5) Filter by parameter value to search for product with specific configurations.

e. Network-wide firmware upgrading remotely via the BACnet/IP network.

1) Mass firmware update of entire rooms.

2) Mass firmware update of specifically selected rooms or areas.

3) Mass firmware upgrade of specific products.

f. WattStopper Product Number: LMCS-100, LMCI-100.

PART 3 – EXECUTION

3.01 SYSTEM ARRANGEMENT

A. System arrangement shall be consistent with the component locations and riser diagram shown on the drawings.

B. Precise as-built mark-ups (illustrating actual field wiring arrangements and equipment configurations) shall be submitted to the Engineer.

3.02 INSTALLATION

A. Wiring:

1. It is the intent of this specification that all associated wiring (per manufacturer's requirements) shall be the responsibility of this Contractor.

2. All concealed control wiring shall be low voltage (as required) plenum cable.

3. All exposed wiring shall be installed in dedicated electrical metallic tubing with set-screw type couplings and connectors for interior dry locations.

B. It shall be the Contractor's responsibility to locate and aim sensory in the correct location required for complete and proper volumetric coverage within the range of coverage(s) of controlled areas per manufacturer's recommendations:

1. Locations and quantities of devices shown on drawings are diagrammatic and indicate only the rooms that are of the control system; provide additional devices if required to properly and completely cover the respective room.

C. The Contractor shall arrange a pre-installation meeting with the manufacturer's factory authorized representative to verify placement of sensors and installation criteria.

D. Provide the training necessary to familiarize the Owner's personnel with the operation, use, adjustment and problem-solving diagnosis of the daylight control devices.

3.03 SUPERVISION

A. General:

1. Supervision and testing shall be executed by the manufacturer's authorized technician.

B. Supervision:

1. Provide on-site observation throughout the system construction period lending all guidance necessary to insure a proper installation.

2. Perform the prescribed "systems demonstration" and "instruction".

3. Provide as-built drawings.

3.04 FACTORY COMMISSIONING

A. Upon completion of the installation, the system shall be completely commissioned by the manufacturer's factory authorized technician, who will verify all adjustments and sensor placement to ensure a trouble-free occupancy-based lighting control system.

1. Occupant sensor controls.

a. Certify that the occupant sensor has been located and aimed in accordance with manufacturer recommendations.

b. Test each unique combination of sensor type and space geometry. Where multiples of each unique combination of sensor type and space geometry are provided, not less than 10 percent, but in no case less than one, of each combination shall be tested. Where 30 percent or more of the tested controls fail, all remaining identical combinations shall be tested.

1) Where occupant sensor controls include status indicators, verify correct operation.

2) The controlled lights turn off or down to the permitted level within the required time.

3) For auto-on occupant sensor controls, the lights turn on to the permitted level when an occupant enters the space.

4) For manual-on occupant sensor controls, the lights turn on only when manually activated.

5) The lights are not incorrectly turned on by movement in adjacent areas or by HVAC operation.

B. Provide building owner certified documentation within 90 days from the date of receipt of the certificate of occupancy the digital occupancy-based lighting and control systems have been certified to the above parameters.

3.05 INSTRUCTION

A. Provide thorough demonstrative instruction (4-hour session) via factory trained technicians (representatives of the manufacturer's authorized distributor), secure the Owner's written acknowledgement and submit to the Engineer.

END OF SECTION

SECTION 26 69 70

IDENTIFICATION

PART 1 – GENERAL

1.01 REQUIREMENTS

A. Furnish and install identification for all equipment, cover plates, conduit, wire and cable and underground utilities.

B. Identification shall include labels, warning tape and ceiling markers.

PART 2 – PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Brady, Seton, Thomas and Betts.

2.02 DESCRIPTION

A. Labels:

1. Exterior equipment:

   a. Standard, phenolic, engraved nameplates.

   b. Appropriately sized lettering:

      i. Large equipment:

         1. 3/4” high by 1/2”.

      ii. Small equipment:

         1. 3/8” high by 1/4”.

2. Interior equipment:

   a. Industrial-strength, tear-proof, laminated tape, moisture resistant, extreme temperature, UV resistant.

   b. 24 mm (1" high) x length as required.

   c. Brother TZe.

3. Cover plates:

   a. Industrial-strength, tear-proof, laminated tape, moisture resistant, extreme temperature, UV resistant.

   b. 6 mm (1/4" high) x length as required.

c. Brother TZe.

4. Conduit:

a. Semi-rigid plastic with pre-set curl (designed to "snap on" with substantial overlap for smaller sizes and held firmly in place with tie-wraps for larger sizes), complete with panel designation and distribution characteristics.

B. Sleeve markers (small conductors):

1. Abrasion solvent and temperature resistant polyvinyl chloride; designed to form "lock-on", compression fit, permanent heat-stamped legend.

C. Identifying cable ties (large conductors):

1. Abrasion, solvent and temperature resistant nylon; self-locking, permanent heat-stamped legend.

D. Warning tape (underground utilities):

1. Metallic utilities:

a. 4.0 mils thick, 6" wide, appropriate American Public Works Association (APWA) color code and wording identification, heavy duty polyethylene.

2. Non-metallic utilities:

a. 4.5 mils thick, 6" wide, metallic, appropriate American Public Works Association (APWA) color code and wording identification, heavy duty polyethylene.

E. Ceiling Markers:

1. 3/4" diameter, 1/16" thick self-adhesive label, blue.

PART 3 – EXECUTION

3.01 INSTALLATION

A. Equipment labels (using the precise alphanumerical designation shown on the drawings) shall be securely mounted (in a conspicuous position) with appropriate fasteners and shall be applied to ALL equipment.

B. Cover plate labels (using the exact panelboard name and associated branch circuit number as field installed) shall be securely mounted (in a conspicuous position horizontal to the floor slab) to ALL cover plates.

C. Conduit labels shall be located to ensure continuous systems identity.

D. Identify ALL wire and cable at ALL terminations.

E. Mark the location of all data cable drops located above the ceiling provided for future use with ceiling markers attached to ceiling grid system to help in identification.

END OF SECTION

SECTION 31 12 01
SITE PREPARATION

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

The general provisions of the Contract, including General and Supplementary Conditions and General Requirements (if any), apply to the work specified in Division 31, 32 and 33.

1.02 DESCRIPTION OF WORK

A. The extent of site preparation is shown on the drawings.

B. Site preparation work includes, but is not limited to, the following:

1. Site investigation and underground utility identification
2. Protection of existing trees, shrubs, ground covers and lawns to remain
3. Site clearing and removals
4. Temporary construction fences and gates
5. Saw cutting pavement
6. Relocations/salvaged materials
7. Clean up

C. Provide materials, labor, equipment and services required to accomplish related work in accordance with the drawings and specifications.

1.03 RELATED WORK SPECIFIED ELSEWHERE

A. Section 011100 – Summary of Work

B. Section 015000 - Temporary Facilities and Controls

C. Section 017700 – Project Closeout

D. Section 312201 - Site Earthwork

1.04 SITE INVESTIGATION

A. The Contractor shall visit the site before bidding, inform and familiarize themselves of all site conditions, including but not limited to, site topsoil, sub-soil, rock, subsurface and groundwater conditions affecting proposed work. No allowance or additional cost will be made in the work of this contract for failing to determine overall project site conditions.

B. Verify locations and protect utilities and structures, whether or not shown on the drawings. Existing utilities and structures shown on the drawings are for the Contractor's convenience and locations are not guaranteed.

C. Verify survey information given on drawings. Walk the site with the City DPW and/ County DPW Representative, Utility Company Personnel and/or MVCC Facilities Management Personnel to discuss approximate locations of reputed utilities not shown on the survey, prior to performing work. Notify the Architect of any and all discrepancies prior to commencing work. Commencement of work will be construed as complete acceptance of survey information.

D. Locate and protect from disturbance existing survey monuments, pins, markers and benchmarks whether or not shown on drawings. When any disturbance or damage occurs, notify Architect in writing within 24 hours. Describe nature of disturbance or damage and date first occurred. Provide copies to applicable government and municipal agencies. Pay costs for restoring monument to satisfaction of said agencies, at no additional expense to the Owner.

1.05 JOB CONDITIONS

A. The terms "Architect" and "Landscape Architect" for Divisions 31, 32 and 33 work shall mean Appel Osborne Landscape Architecture, 102 West Division St., Suite 100, Syracuse, NY 13204, Tel. (315) 476-1022. Facsimile (315) 479-7573 or other representative(s) that Oneida County/ MVCC may determine. The term “Owner” shall refer to Oneida County.

B. Examine drawings and specifications for the entire project. Become familiar with the scope and sequencing of work required. Coordinate and cooperate with other Contractors and trades working in and adjacent to the project.

C. Examine work prepared prior to this contract. Commencement of work will be construed as complete acceptance of all preparatory work by others.

D. Obtain and pay for permits and/or fees required by authorities. Perform the work in compliance with applicable standards, codes and requirements of governing authorities having jurisdiction.
1. City of Utica DPW Curb Cut Permit
2. City of Utica DPW Street Opening Permit
3. Mohawk Valley Water Authority, (MVWA) inspections
4. Water testing, (disinfection and bacteriological report).

E. Safety is the sole responsibility of the Contractor.

F. Burning on site and use of explosives are not permitted.

G. Responsibility for existing utilities:

1. Contact Dig Safely New York at least two (2) full working days, and not more than ten (10) working days, before digging begins or as required by latest state law. Locate by hand excavation and provide protection from damage to existing utilities to remain in the area. (Tel. 811)

2. Existing utilities encountered within excavated areas shall be supported, blocked and/or braced in a manner approved by the owner of the utility. Leave supports in place to the extent required by the owner of the utility.

3. Should uncharted or incorrectly charted utilities be encountered, notify the Architect immediately for directions as to procedure.

4. Do not break utility connections without providing temporary services as acceptable to the Architect and the owner of the utility.

5. Repair and pay for damages to existing utilities as directed by utility Owner at no additional cost to the Owner.

6. Cap ends of utilities to be abandoned or removed in accordance with regulatory agencies and as directed by the Architect.

H. Provide protections and conduct operations to prevent injury and damage to persons, work of other Contractors, existing items to remain, structures, pavements, lawns, and adjacent properties.

I. Restore work damaged by this Contractor inside and outside the contract limits to the condition existing prior to the start of work, unless otherwise directed to the satisfaction of the Architect at no additional cost to the Owner.

J. Vehicular and pedestrian traffic control:

1. Maintain vehicular and pedestrian traffic during construction activities.

2. Provide alternate routes and traffic control around closed and obstructed traffic ways as required by governing regulations or the Owner.

3. Provide temporary fencing, flag persons, barricades, warning signs, and warning lights or other measures to protect the public and cause the least interruption of work.
4. Implement Work Zone Traffic Control practices when working in Right-of-ways. (Refer to NYSDOT Work Zone Traffic Control Manual for standards of practice).

K. Field Measurements: Take necessary field horizontal and vertical measurements required in order to perform the work and design intent shown on the drawings, and outlined in the specifications. Assume complete responsibility for accuracy of such measurements and dimensions.

L. Removal of spoils, dust control, debris, and clean up:

1. Control air pollution caused by dust and dirt; comply with governing regulations. Water to control dust when necessary and as directed by the Architect or Certified Erosion Control Specialist. Provide water sprinkling materials, equipment and labor to prevent the nuisance of dust to the surrounding areas.

2. Legally dispose of removed and demolished items, including trash and debris, off the Owner's property, at a licensed disposal facility having adequate capacity to accept the project's waste.

3. Burning of combustible materials on the site is not permitted.

4. During the contract and at intervals as directed by the Architect, clear the site of extraneous materials, rubbish, construction waste, and debris. Leave the site in a clean, safe, neat, well-draining condition.

5. Tracking soil: Sweep roads, access ways, paved areas, and parking areas where soil, mud and debris have dropped or tracked from construction and delivery vehicles on a daily basis and as directed by the Architect or Certified Erosion Control Specialist.

6. Spoils: Remove from site and dispose of soil material not required for fill or determined to be unsatisfactory soil material per Section 312201 - Site Earthwork.

M. Construction Review - General: Site visits will be made by the Architect to observe construction conformance to drawings and specifications. The occasional site visits by the Architect shall not be construed as supervision of construction or make them

responsible for the safety programs and precautions, including but not limited to: the safe access, visit, use, work travel, or occupancy of any person. Site visits shall not make the Architect responsible for means, methods, techniques, sequences or procedures of construction selected by the Construction Manager, Contractor or his Sub-contractors.

N. Site Complexity: The existing site will be intensively developed. Because of the construction and resulting graphic complexity, it is impractical to show every detail. However, the general design intent is clearly shown and shall be applied to individual conditions not specifically shown as directed by the Architect and at no additional cost to the Owner.

O. Asbestos, Toxic and Hazardous Materials: The Division 31, 32 and 33 site work contract does not include testing for, handling or removal of hazardous materials such as, but not limited to: asbestos, fuel, oil, PCB's, or other toxic or hazardous waste materials as identified by the EPA and/or NYSDEC. If any such materials are encountered during any part of the site work, the Contractor is responsible for identifying potential hazardous material and immediately notify all governing agencies having jurisdiction as required by law. Also, within one (1) hour of discovery notify the Architect, Landscape Architect, Consultants, and Owner. The Owner shall provide testing and removal by others, under separate contract. The Contractor shall recommence work under this contract when the Owner provides written certification that remediation is complete per governing agency. The Contractor shall not be penalized for any delays caused by the hazardous testing and removal, unless such hazardous material incident was a result of Contractor's operations. The Contractor shall indemnify and hold harmless the Architect, Landscape Architect, Consultants and Owner, agents, and employees from and against all claims, damages, losses and expenses, direct and indirect or consequential damages, including but not limited to fees and charges of attorneys and court and arbitration costs, arising out of or resulting from the performance of the work by the Architect, Landscape Architect, Consultants and Owner, or claims against the Architect, Landscape Architect, Consultants and Owner arising from the work of others, related to hazardous waste.

The above indemnification provision extends to claims against the Architect, Landscape Architect, Consultants and Owner which arise out of, are related to, or are based upon, the dispersal, discharge, escape, release or saturation of smoke, vapors, soot, fumes, acids, alkalis, toxic chemicals, or pollutant in or into the atmosphere, or on, onto, upon, in or into the surface or subsurface soil, water or water courses, objects, or any tangible or intangible matter, whether sudden or not.

Should the hazardous material incident be the result of the Contractor's operations, the Contractor shall be responsible for all costs associated with the discovery and remediation of such hazardous material such as, but not limited to: testing, consultant fees, damage, loss, fees and charges of attorneys, court and arbitration costs, claims by other contractors, direct and indirect or consequential damages.

P. Salvageable Items: Remove at any time after work starts. Storage or sale on site of salvageable and removed items is not permitted. Do not remove topsoil from site without written permission from the Owner.

Q. Relocated Items: Remove and protect at any time after work starts. Store on site until scheduling of work allows re-installation. Install items as detailed and as shown on the plan, matching original condition. Items include, but not limited to:

1. Traffic/ parking signs
2. Campus map kiosk sign box
3. EV charging stations
4. Metal handrails

5. Granite stair treads
6. Light poles and fixtures
7. Flagpoles (3 total)

Clean, reinstall or return to Owner as indicated on the drawings, (refer to Site Preparation Plan).

R. Stormwater Pollution Prevention Plan, (SWPPP) Maintenance: The Site Contractor is responsible to provide, install and maintain all erosion control measures throughout construction activity. Refer to Section 312501- Erosion, Sediment and Pollution Control

S. Snow Removal: Snow removal within the project site is not required under the Site Contract.

T. SUBMITTALS/PROCEDURES: Submit Tests, Shop Drawings, Material Certificates (showing content/mechanical analysis) and Manufacturer's Product Data (MPD) to Architect for review a minimum of two (2) weeks prior to installation.

1. From material producer, manufacturer, or laboratory, stamped as checked and approved by the Contractor before submittal to the Architect or as otherwise indicated in Division 1. (Note: Electronic submittal process may be acceptable when approved by the Owner and Architect.)

2. Refer to individual specification sections for a list of required submittals.

3. For each material certificate required, provide certification by an Architect approved independent testing laboratory which gives analysis results and states that the material complies with or is superior to the specified requirements.

1.06 SUBMITTALS: (See 1.5, above)

A. Provide photographic documentation. Photographically document existing features which, may be affected by the construction, inside and outside the contract limit line. Existing features include, but are not limited to: structures, pavements, curbs, utilities, lawns and vegetation, especially individual trees which are over six (6") inches in diameter and noted to remain on the drawings. Also, particular attention shall be paid to the construction access, stockpile and haul road areas. Distribute a copy of the photographic documentation (digital format) to the Owner and Architect prior to the start of construction.

B. Provide material certificate showing content/mechanical analysis for temporary staging area stone pavement.

C. Temporary fence, and gates; Manufacturer's Product Data (MPD).

PART 2 - PRODUCTS

2.01 TEMPORARY CHAIN LINK FENCE AND GATES

A. Shall be new or used good quality 6'-0" height galvanized chain link fence and gates with driven posts.

B. Location(s) shall be as shown as on the drawings and/or as directed by the CM/ Owner.

2.02 TEMPORARY MOVABLE FENCE

A. Shall be new or used good quality 6'-0" height galvanized chain link fence panels with stanchions. Panels shall be inter-locking, 2-inch/ 11.5-gauge mesh, Provide sandbags for stability.

B. Locations shall be as shown on the drawings and/ or as directed by the Owner/ CM.

2.03 PLASTIC FENCE

A. Shall be new or used good quality used 4'-0" high heavy duty orange plastic fence NC450.

B. Posts shall be new U-channel posts to hold plastic fence.

2.04 OTHER PROTECTIVE DEVICES

A. Shall include, but not be limited to; wood planks, rubber mats, barriers, lights, barricades, coverings, traffic controls, steel plates, and other temporary protections.

B. Contractor to provide all necessary protections required by Occupational Safety and Health Administration (OSHA).

2.05 STAGING AREA(S)

A. Staging Area(s) located in non-paved surfaces: Shall be run of crusher limestone meeting the following gradation as determined by ASTM-C136:

Standard Sieve Size	Percent Passing By Weight
2" or 50 mm	100%
3/4" or 19 mm	75 - 90%
1/4" or 6.3 mm	30 - 65%
#40 or 425 mm	5 - 40%
#200 or 75 mm	0 - 8%

B. Soil Stabilization Fabric: Shall be a commercially manufactured, UV stabilized low clogging, high flow, woven geotextile. Standard of quality shall be Mirafi 500X, as manufactured by NICOLON/MIRAFI GROUP, 3500 Parkway Lane, Norcross, Georgia (Tel. 1-800-234-0484) or Architect approved equal.

C. Staging areas located in existing paved surfaces or parking lots shall be protected from damage throughout construction. Provide temporary protective coverings, blocking or pellets for stored materials and trailers.

2.06 CONSTRUCTION MATTE

A. #2 or #3 crushed limestone used for working matte around the building footprint.

PART 3 - EXECUTION

3.01 PROTECT EXISTING VEGETATION TO REMAIN

A. Prior to commencing site preparation work, notify Architect, and meet on site to locate existing trees, lawns and vegetation which are to remain or protected, (either within the contract limit line or adjacent).

B. Protect and keep existing vegetation to remain free from physical damage. Keep in a healthy, vigorous growing condition for the entire construction period as follows:

1. Keep site disturbance and staging limits to a minimum. Obtain approval from Owner for material and equipment storage areas. Limit access points and routes to the project site. Coordinate site access with other trades and contractors on the work site.

2. Groups of Trees and Vegetation: Place orange plastic construction fencing around drip line(s) of trees and plant beds as detailed or directed by the Architect. Do not store materials, run equipment, park vehicles, or otherwise disturb area within the drip line (full canopy of tree) or in plant beds.

3. Specimen and Individual Trees: Protect each as noted. Do not store materials, run equipment, park vehicles or otherwise disturb area within the drip line (full canopy of tree).

C. Rejuvenate damaged vegetation by pruning watering, fertilizing, staking and other methods as directed by the Architect. Replace trees and other vegetation that cannot be restored to full growth with comparable size, quantity, quality and species as determined by the Architect.

D. Repair lawns disturbed due to construction operations outside the grading limits, as specified and directed by the Architect. Provide screened topsoil, seed, and mulch over damaged lawn areas, access ways or where tire rutting occurred.

3.02 SITE CLEARING AND REMOVALS

A. Items and materials noted to be removed shall become the property of the Contractor, unless otherwise noted. Obtain Owner's approval prior to removal off site or for relocation of salvaged material on site. Remove material off site and legally dispose of it. Backfill voids with imported granular backfill, placed in eight (8") inch layers compacted to 95% maximum density.

B. Remove physical elements above and below grade as shown and which interfere with proposed construction. Physical elements include but are not limited to: trees, root systems, vegetation, pavements, curbs, gutters, foundations, construction debris, glass, abandoned underground tanks, unused utilities, pipes, cisterns, walls, rocks, and other debris.

C. Trees, shrubs and roots shall be completely removed and disposed of legally off site.

D. Maintain existing utilities shown to remain and protect from damage during demolition and construction operations. Do not interrupt existing utilities; provide temporary services when required, as acceptable to the Architect.

E. Research with Owner possible locations of existing subsurface utilities prior to excavating.

3.03 TEMPORARY CONSTRUCTION STAGING AREAS

A. Install soil stabilization fabric as specified and overlap fabric two (2') feet minimum. Provide 95% compacted staging area/construction road stone for temporary construction roads and staging areas as shown on the drawings and as required by the Contractor to access the proposed work. Refer to the plans for location(s) and pavement depth.

B. Near the project completion, remove the stone staging area/construction roads and soil stabilization fabric. Recondition and decompact existing topsoil, fine grade, and seed as directed by the Architect to match existing lawn conditions. Near the project completion, repair asphalt and concrete to match existing conditions, power wash area, seal coat asphalt, patch, and repaint parking lines as directed by the Architect.

C. Construction Matte: Provide 6-inch depth temporary stone matte around the building footprint for stabilization. Remove stone matte prior to final paving and lawn restoration.

3.04 SAW CUTTING

A. The Work consists of vertical saw cutting of the existing asphalt or concrete pavement structure to facilitate the removal of the asphalt or concrete bound material.

B. The equipment shall be capable of producing a smooth vertical saw cut without causing damage to the adjacent pavements or related site features.

C. The Contractor shall saw cut the asphalt/concrete pavement to a depth which will allow removal of the material without causing damage to the adjacent pavement. Rough, jagged or cracked edges will not be acceptable. Concrete pavement shall be removed at the nearest contraction joint.

3.05 RELOCATIONS

A. Any item noted to be relocated shall be removed by the Contractor from its existing position without damaging it, stored, protected from theft, fire, vandalism and damage for the project duration. Reset in the location(s) and in the manner detailed, noted on the drawings or specified.

B. Backfill voids with imported granular fill material, placed in eight (8") inch layers compacted to 95% maximum density when located in proposed pavement areas or 90% maximum density when located in proposed non-paved areas.

C. Salvaged items shall be returned to the Owner as noted on the drawings. Move items to Owner designated areas.

3.06 CLEAN UP

During the contract and at intervals as directed by the Architect and as site preparation is completed, clear the site of extraneous materials, rubbish, and debris. Leave the site in a clean, safe, well draining, neat condition.

END OF SECTION 31 12 01

SECTION 31 20 00

BUILDING EARTH MOVING

PART 1 - GENERAL

1.01 GENERAL DISCUSSION

A. The results of the Subsurface Conditions identified in the Subsurface Explorations and Test Pits at the Project Site indicate the site contains unsuitable / unreliable bearing materials (existing uncontrolled fill) ranging from about 3-feet to 13-feet below existing grades, underlain by a buried organic layer (to approximately 8 to 11 feet below existing grade in areas). The existing fill material does not appear to have been placed in a prepared manner and meets the Building Code definition of “Unprepared Fill” and is assigned a zero-bearing capacity by the Building Code and is deemed “Unsuitable Soils”. The buried organic layer is also not reliable bearing material to support building foundations and slabs-on-grades. Refer to the “Referenced Geotechnical Information and Reports” indicated in Article 1.04 and in the Project Manual for additional information.

The Building Pad Site Preparation with Ground Improvements, the Foundation System and Design Parameters, and the General Notes presented on the drawings, within this specification section (31 20 00 “Building Earth Moving”) and within specification Section 31 66 13 (“Aggregate Piers”) are based on information contained within the referenced Geotechnical Information and Reports as prepared by CME Associates, Inc., including various email communications and multiple conference calls between CME Associates and members of the Project Team throughout the Design and Document preparation process and generally accepted good engineering practices.

Based on the information provided and discussed during the design process, the existing subsurface conditions identified in these Reports are not favorable to support the proposed structures utilizing conventional “Shallow Foundations and Slabs-on-Grade” system without incorporating a “Ground Improvement System”.

To allow for the installation of conventional “Shallow Foundations and Slabs-on-Grade” systems as designed and as shown on the Contract Documents for the Proposed Buildings, the Ground Improvement System indicated below is required to be completely installed and tested under the entire footprint of both the Head Building and the Shed Building prior to the start of the “Building Earth Moving” work required for the construction of these buildings.

B. GROUND IMPROVEMENT SYSTEM WITH AGGREGATE PIERS (aka: STONE COLUMNS) AND LOAD TRANSFER PLATFORMS (LTPs):

1. The conventional “Shallow Foundations and Slabs-on-Grade” systems as designed and as shown on the Contract Documents for the Proposed Buildings assumes the existing the existing Fill and the buried Organic layer shall be left in-place and shall be improved via a Ground Improvement System consisting of Aggregate Piers and Load Transfer Platforms (LTPs). The conventional shallow footing foundation and slabs-on-grade systems shall bear on the Load Transfer Platforms (LTPs).

2. The Aggregate Pier system is a proprietary Ground Improvement System used for settlement control and to improve bearing characteristics of poor or weak soils. Within this system, Aggregate Piers shall be installed using specialty designed tooling, which laterally displaces the soils as the element is installed. The behavior of the soil surrounding the Aggregate Piers is often improved due to the increased lateral strain that results from the displaced drilling technique.

3. The Aggregate Pier Ground Improvement System shall include a Load Transfer Platform

(LTP) to assist in load transfer between the foundation elements and the Aggregate Piers. The LTP shall be a “Delegated Design” by the Aggregate Pier Specialty Contractor (Ground Improvement Contractor), shall meet the performance Specification and General Requirements provided within the Contract Documents and shall be installed by a Specialty Ground Improvement Contractor / Earthwork Contractor. The LTP is typically comprised of well-graded Granular Material, such as NYSDOT Type 2 Subbase Course material (Run-of-Crush Limestone).

4. The Ground Improvement System shall be designed and installed to provide and allowable soil bearing pressure of 4,000 psf (with a minimum Factor of Safety of 2.0) for the support of the footing foundations and a modulus of subgrade Reaction of 200 PCI for support of the Slabs-on-Grade.

5. The Ground Improvement System shall be designed and installed by a specialty Contractor responsible for creating an improved and suitable Building Pad. This procedure requires continual on-site observations and Testing by the Owner provided Inspecting Professional Geotechnical Engineer (IPGE) Special Inspector and shall be completed prior to any excavation for the proposed foundation systems.

6. Refer to Specification Section 31 66 13 (“Aggregate Piers’) and the Structural Contract Drawings for additional information related to the requirements of the Ground Improvement System, including but not limited to, Building Pad Site Preparation / Ground Improvement General Notes; Building Foundation System and design parameters; Load Testing of the Ground Improvement System; Special Inspections of the Ground Improvement System; and Pre-Construction Existing Condition Surveys and Vibration Monitoring.

1.02 RELATED DOCUMENTS

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

1.03 SUMMARY

A. This Section includes the following:

1. Preparing subgrades for slabs supported on-grade.
2. Excavating and backfilling for buildings, equipment support pads, entry pads / frost walls and miscellaneous structures.
3. Subbase course for slabs supported on-grade.
4. Excavating and backfilling trenches within building lines.

B. Related Sections include the following:

1. Division 1 Section 01 45 33 “Code-Required Special Inspections and Procedures” for independent testing agency procedures and administrative requirements.
2. Division 01 Section "Allowances" for quantity allowance provisions related to unit-price rock excavation and authorized additional excavation.
3. Divisions 22, 23 and 26 for installing underground mechanical and electrical utilities and buried mechanical and electrical structures.
4. Division 31 Section 31 66 13 “Aggregate Piers” for the requirements of the Delegated Design, Installation and Testing of the Ground Improvement System consisting of Aggregate Piers (APS) and Load Transfer Platforms (LTPs) to support all footing foundations and Slabs-on-Grade for the Head and Shed Buildings.

1.04 REFERENCED GEOTECHNICAL INFORMATION AND REPORTS

A. The Building Pad Site Preparation with Ground Improvements, the Foundation System and Design Parameters, and the General Notes presented on the drawings, within this specification section (31 20 00 “Building Earth Moving”) and within specification
Section 31 66 13 (“Aggregate Piers”) are based on information contained within the following referenced Geotechnical Information and Reports as prepared by CME Associates, Inc., including various email communications and multiple conference calls between CME Associates and members of the Project Team throughout the Design and Document preparation process and generally accepted good engineering practices.

1. “Subsurface Exploration and Foundation Recommendation Report”, Mohawk Valley Community College Science and Technology Building, Utica, NY, CME Report No. 28107B-01-0224, Dated February 23, 2024.
2. “Subsurface Exploration and Foundation Recommendation Report – Addendum 1”, Mohawk Valley Community College Science and Technology Building, Utica, NY, CME Report No. 28107B-02-0824, Dated August 05, 2024.

1.05 DEFINITIONS

A. Backfill: Soil materials or controlled low-strength material used to fill an excavation.

1. Initial Backfill: Backfill placed beside and over pipe in a trench, including haunches to support sides of pipe.
2. Final Backfill: Backfill placed over initial backfill to fill a trench.

B. Bedding Course: Layer placed over the excavated subgrade in a trench before laying pipe.

C. Imported Borrow Soil: Satisfactory soil imported from off-site for use as fill or backfill.

D. Subbase Course: Layer below the vapor retarder / barrier supporting slab supported on-grade used to minimize capillary flow of pore water.

E. Excavation: Removal of material encountered above subgrade elevations and to lines and dimensions indicated.

1. Authorized Additional Excavation: Excavation below subgrade elevations as directed by the Architect or the Owner’s designated On-site Representative. Authorized additional excavation and replacement material will be paid for according to Contract provisions for unit prices or changes in the Work.
2. Bulk Excavation: Excavations more than 10 feet in width and more than 30 feet in length.
3. Unauthorized Excavation: Excavation below subgrade elevations or beyond indicated lines and dimensions without direction by the Architect or the Owner’s designated On-site Representative. Unauthorized excavation, as well as remedial work not directed by the Architect or the Owner’s designated On-site Representative, shall be without additional compensation.

F. Common Fill: Satisfactory soil material from excavated on-site soils, including suitable existing fill, or imported from off-site. Common fill soil material is to be used in landscape areas outside of structural areas.

G. Select Granular Fill: Select Granular Fill shall consist of Imported well-graded sand and gravel borrow material, approved recycled product or crushed rock product which meets the quality and gradation requirements of Table 1 provided in Article 2.01, “Soil Materials” for Select Granular Fill

Material. The material shall be capable of being compacted to the required density at the proper moisture content and shall be free of deleterious materials, trash, roots, debris, frozen material and organic or other foreign matter.

Select Granular Fill to be used within the building pad shall be free of Recycled Asphalt Pavement (RAP) products.

As indicated in Article 2.01, “Soil Materials” for Select Granular Fill Material, the Select Granular Fill material shall be accepted based on gradation, soundness, plasticity index and a well-defined Moisture-Density Relationship Curve. Imported Select Granular Fill to be placed within 2'-0" of final exterior grade shall be subjected to Soundness requirements. Soundness shall be less than 30% loss based on a four-cycle magnesium sulfate soundness test. Plasticity Index of that portion of fill material passing the No. 40 mesh sieve shall not exceed 5.0.

The moisture content of this material shall be adjusted prior to application of compaction such that it is within 3% of Optimum Moisture Content as established by the Inspecting Professional Geotechnical Engineer (IPGE) and testing laboratory.

Select Granular Fill material shall be used for:

1. General grade increases within the Building Pad / Equipment Support Pads / Entrance Pads / Frost walls or within the Influence Area of the Foundations.
2. Backfilling and Filling against the interior and exterior surfaces of foundation walls, including under building floor slabs-on-grade within the Building Pad / Equipment Support Pads / Entrance Pads / Frost walls or within the Influence Area of the Foundations.
3. Filling and backfilling of undercut areas requiring remediation (including excavation of yielding and unsuitable existing soil or organic materials) within the Building Pad or within the Influence Area of the Foundations.

Refer to Article 2.01, “Soil Materials” for Select Granular Fill Material for additional information.

H. Load Transfer Platform (LTP) Fill: Refer to the Approved Aggregate Pier Submittal for LTP Material Specifications as indicated in Project Specification Section 31 66 13 (Aggregate Piers). The LTP is associated with the required Delegated Design of the Ground Improvement System with Aggregate Piers and Load Transfer Platforms (LTPs).

1. See Article 2.01, “Soil Materials”, for additional information.
2. Refer to the Structural Contract Drawings for additional information regarding the Building Pad Site Preparation / Ground Improvement General Notes and the Building Foundation system and design parameters.

I. Rock: Unclassified earth material in beds, ledges, unstratified masses, and conglomerate deposits and boulders of rock material exceeding 1 cu. yd. for bulk excavation or 3/4 cu. yd. for footing, trench, and pit excavation that cannot be removed by rock excavating equipment equivalent to the following in size and performance ratings, without systematic drilling, ram hammering, ripping, or blasting (Note: Blasting is NOT permitted):

1. Excavation of Footings, Trenches, and Pits: Late-model, track-mounted hydraulic excavator; equipped with a 42-inch- wide, short-tip-radius rock bucket; rated at not less than 120-hp flywheel power with bucket-curling force of not less than 25,000 lbf and stick-crowd force of not less than 18,700 lbf; measured according to SAE J-1179.
2. Bulk Excavation: Late-model, track-mounted loader; rated at not less than 210-hp flywheel power and developing a minimum of 45,000-lbf breakout force; measured according to SAE J-732.

J. Structures: Buildings, footings, foundations, retaining walls, slabs, tanks, curbs, mechanical and electrical appurtenances, or other man-made stationary features constructed above or below the ground surface.

K. Subgrade: Surface or elevation remaining after completing excavation, or top surface of a fill or backfill immediately below subbase, Subbase Course, crushed stone pads or topsoil materials.

L. Utilities include on-site underground pipes, conduits, ducts, and cables, as well as underground services within buildings.

M. Building / Equipment Support Pads / Entrance Pads / Frost Walls: The Building / Equipment Pad Building Pads / Entrance Pads / Frost walls is defined as the following:

1. The Buildings / Equipment Pad Building Pads / Entrance Pads / Frost walls: The area within the footprint of the proposed buildings, the equipment support pads, the entrance pads or the frost walls, plus adjacent slabs and sidewalks, plus a five (5) foot nominal buffer all around.

N. Influence Area of Foundations: The influenced area of the foundations is defined as the area under a plane starting at the bottom of the footing and extending downward and outward at an angle of 45 degrees measured from the horizontal and is measured from:

1. One (1) foot outside the outermost edge at base of foundations, slabs, and rigid pavements.
2. 0.5 feet outside the exterior spring line of pipes and culverts.

1.06 SUBMITTALS

A. Original drawings, prepared by Contractor, Subcontractor, supplier or distributor, which illustrate some portion of the work showing fabrication, layout, setting or erection details.

Refer to Division 1, Section 01 30 00 - “Administrative Requirements” and information within this section for additional submittal requirements.

1. Identify details by reference to sheet and detail numbers shown on shop drawings.
2. Sheet size, multiple of 8 ½ by 11 inches, not to exceed size of contract drawings when unfolded.
3. **Photographic reproductions of contract drawings will <u>NOT</u> be accepted as shop drawings and will be REJECTED without review.**

B. Portable Document Format (PDF) Files: All submittals required for this section (including, but not limited to, Product Data and Material Test Reports) shall be submitted to the A/E in “PDF” electronic format.

C. Product Data: For the following:

1. Each type of plastic warning tape.
2. Controlled low-strength material, including design mixture.
3. 12-by-12-inch sample of geotextile fabric.

D. Material Test Reports: From a qualified testing agency indicating and interpreting test results for compliance of the following with requirements indicated:

1. Classification according to ASTM D 2487 of each on-site or borrow soil material proposed

for fill and backfill.

2. Laboratory compaction curve according to ASTM D1557 for each on-site or borrow soil material proposed for fill and backfill.

E. Pre-excavation Photographs or Video Tape: Pre-excavation Photographs or Video Tape taken by the Contractor shall show existing conditions of adjoining construction and site improvements, including finish surfaces, which might be misconstrued as damage caused by earthwork operations. Submit before earthwork operations begin.

F. Instrument Survey of Exposed Rock Surface Contours: If rock is encountered within the influence area of the building footprint following stripping and removal of all existing asphalt, concrete, top soil and surficial organic or other deleterious / unsuitable existing materials before reaching the intended design bearing depths, the Contractor shall notify the Owner's designated On-site Representative and A/E for additional direction before proceeding. The Contractor shall perform an instrument survey of the exposed rock surfaces to provide a localized topography plan that identifies the elevations of the top of existing rock. This will provide the basis for determination of the actual quantities for construction of the building foundation systems if rock removal is required. This survey shall be provided to the Owner's designated On-site Representative and A/E for review prior to the start of construction.

G. See Specification Section 31 66 13 (Aggregate Piers) for Submittal Requirements associated with the Delegated Design of the Ground Improvement System and materials (Aggregate Piers and Load Transfer Platforms (LTPs).

1.07 QUALITY ASSURANCE

A. Code-Required Special Inspections and Procedures: Work associated with this section is subject to meeting the requirements and qualifications of Division 1 Section 01 45 33 "Code-Required Special Inspections and Procedures".

B. Pre-excavation Conference: Conduct conference at Project site to comply with requirements in Division 01 Section "Project Management and Coordination."

1.08 PROJECT CONDITIONS

A. Existing Utilities: Do not interrupt utilities serving facilities occupied by Owner or others unless permitted in writing by the Architect or the Owner's designated On-site Representative and then only after arranging to provide temporary utility services according to requirements indicated:

1. Notify the Architect or the Owner's designated On-site Representative not less than two days in advance of proposed utility interruptions.
2. Do not proceed with utility interruptions without the Architect's or the Owner's designated On-site Representative's written permission.
3. Contact utility-locator service for area where Project is located before excavating.

B. Demolish and completely remove from site existing underground utilities indicated to be removed. Coordinate with utility companies to shut off services if lines are active.

C. Existing Rock Elevations: Refer to Article 1.07.F for additional criteria associated with the existing rock elevations if applicable.

PART 2 - PRODUCTS

2.01 SOIL MATERIALS

~~A.~~ General: Provide imported borrow soil materials as required.

B. Common Fill: Satisfactory Soil Material from excavated on-site soils, including suitable existing fill, or imported from off-site. Common fill soil material is to be used in landscape areas outside of structural areas.

C. Satisfactory Soil Material: These soils are defined as inorganic soil material, with a maximum particle size less than 4-inches in any dimension, and shall be free of debris, waste, frozen materials, vegetation, and other deleterious matter. These soils shall conform to the Unified Soil Classification System (USCS) Classes GW, GM, GC, GP, SW, SM, ML, ML-CL, SP and SC or a combination of these group symbols and shall exhibit a well-defined Moisture Density Relationship Curve.

D. Unsatisfactory Soil Material: These soils include Unified Soil Classification System (USCS) Classes CH, MH, OH, OL, PT, CL (or a combination of these group symbols) and Miscellaneous Fill, Organic Matter, Cobbles and Boulders.

1. Unsatisfactory soils also include satisfactory soils not maintained within 2 percent of Optimum Moisture Content at the time of compaction, and any soils rejected by the Engineer or the Owner's designated On-site Representative.

E. Select Granular Fill: Select Granular Fill shall consist of <u>Imported</u> well-graded sand and gravel borrow material, approved recycled product or crushed rock product which is capable of being compacted to the required density at the proper moisture content and which is free of deleterious materials, trash, roots, debris, frozen material and organic or other foreign matter.

Select Granular Fill used within the building pad shall be free of Recycled Asphalt Pavement (RAP) products.

Select Granular Fill material shall be accepted based on gradation, soundness, plasticity index and a well-defined Moisture-Density Relationship Curve. Imported Select Granular Fill to be placed within 2'-0" of final exterior grade shall be subjected to Soundness requirements. Soundness shall be less than 30% loss based on a four-cycle magnesium sulfate soundness test. Plasticity Index of that portion of fill material passing the No. 40 mesh sieve shall not exceed 5.0.

Gradation requirements are as provided in Table 1 below.

TABLE 1 – SELECT GRANULAR FILL

Standard Sieve Size Designation	Percent Passing by Dry Weight
4 inch	100
¼ inch	35-65
No. 200	0-10

The minimum requirements for a prequalification submittal shall include the following test results which are not more than 2 months old:

- Sieve Analysis – ASTM D422
- Moisture-Density Relationship – ASTM D1557
- Plasticity Index – ASTM D4318

- Soundness Test – ASTM C88

The moisture content of this material shall be adjusted prior to application of compaction such that it is within 3% of Optimum Moisture Content as established by the Inspecting Professional Geotechnical Engineer (IPGE) and testing laboratory.

F. Load Transfer Platform (LTP) Fill: Refer to the Approved Aggregate Pier Submittal for LTP Material Specifications as indicated in Project Specification Section 31 66 13 (Aggregate Piers). The LTP is associated with the required Delegated Design of the Ground Improvement System with Aggregate Piers and Load Transfer Platforms (LTPs).

1. See Article 1.06, “Definitions”, for additional information.
2. Refer to the Structural Contract Drawings for additional information regarding the Building Pad Site Preparation / Ground Improvement General Notes and the Building Foundation system and design parameters.

G. Bedding Course: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940; except with 100 percent passing a 1-inch sieve and not more than 8 percent passing a No. 200 sieve.

H. Slab Subgrade – Subbase Course (under slabs-on-grade): Imported borrow material consisting of a screened, gravel or crushed stone conforming to all of the requirements of New York State Department of Transportation (NYSDOT) Standard Specification for Item No. 304.12 OR 304.14, Subbase Course Material, Type 2 or Type 4 or approved equal, placed over compacted foundation subgrades. The moisture content of this material shall be adjusted prior to application of compaction such that it is within 3% of Optimum Moisture Content as established by the Inspecting Professional Geotechnical Engineer (IPGE) and testing laboratory.

I. Filter Material: Narrowly graded mixture of natural or crushed gravel, or crushed stone and natural sand; ASTM D 448; coarse-aggregate grading Size 67; with 100 percent passing a 1-inch sieve and 0 to 5 percent passing a No. 4 sieve.

J. Impervious Fill: Clayey gravel and sand mixture capable of compacting to a dense state.

K. Sand: ASTM C 33; fine aggregate, natural or manufactured sand.

2.02 GEOTEXTILE FABRICS

A. Geotextile Fabric: Needle Punched, nonwoven, polypropylene geotextile fabric (Mirafi 180 N, or as approved equal) meeting the following material properties and performance criteria:

1. Grab Tensile Strength @ Ultimate: 205 lbf; ASTM D 4632.
2. Grab Tensile Strength Elongation @ Ultimate: 50 percent; ASTM D 4632.
3. Mullen Burst Strength: 380 psi; ASTM D 3786.
4. Trapezoidal Tear Strength: 80 lbf; ASTM D 4533.
5. CBR Puncture Strength: 500 lbf; ASTM D 6241.
6. UV Resistance: 70 percent after 500 hours' exposure; ASTM D 4355
7. Apparent Opening Size: No. 80 US Sieve, maximum; ASTM D 4751.
8. Permittivity: 1.4 per second, minimum; ASTM D 4491.
9. Permeability: 0.21 cm/sec, minimum; ASTM D 4491.
10. Flow Rate: 95 Gallons per minute per ft^2 ; ASTM D 4491.
11. Weight: 8.0 oz per yd^3 ; ASTM D 5261.

12. Thickness: 72 mils, ASTM D 5199.

2.03 CONTROLLED LOW-STRENGTH MATERIAL

A. Controlled Low-Strength Material: Low-density, self-compacting, flowable concrete material as follows:

1. Portland Cement: ASTM C 150, Type I, II, or III.
2. Fly Ash: ASTM C 618, Class C or F.
3. Normal-Weight Aggregate: ASTM C 33, 3/4-inch or 3/8-inch nominal maximum aggregate size.
4. Water: ASTM C 94/C 94M.
5. Air-Entraining Admixture: ASTM C 260.

B. Produce conventional-weight, controlled low-strength material with 140-psi compressive strength when tested according to ASTM C 495.

2.04 ACCESSORIES

A. Warning Tape: Acid- and alkali-resistant polyethylene film warning tape manufactured for marking and identifying underground utilities, 6 inches wide and 4 mils thick, continuously inscribed with a description of the utility; colored as follows:

B. Detectable Warning Tape: Acid- and alkali-resistant polyethylene film warning tape manufactured for marking and identifying underground utilities, minimum 6 inches wide and 4 mils thick, continuously inscribed with a description of utility, with metallic core encased in a protective jacket for corrosion protection, detectable by metal detector when tape is buried up to 30 inches deep; colored as follows:

1. Red: Electric.
2. Yellow: Gas, oil, steam, and dangerous materials.
3. Orange: Telephone and other communications.
4. Blue: Water systems.
5. Green: Sewer systems.

PART 3 - EXECUTION

3.01 PREPARATION

A. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by earthwork operations.

B. Site preparation for the areas within the footprint of the proposed building shall be the responsibility of the site contractor per the provisions of specification section 31 12 01. If remnants of any former structures are disclosed during site preparation, they shall be removed in their entirety beneath the area within the footprint of the building addition, the equipment support pads, the entrance pads or the frost walls and Influence Area of the Foundations unless shown otherwise. The removals shall take place in the presence of the Inspecting Professional Geotechnical Engineer (IPGE) who will verify satisfactory removals have been completed.

C. Provide erosion-control measures to prevent erosion or displacement of soils and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways.

D. Refer to the Article 1.07.F for additional information related to an instrument survey of exposed Rock Surface Contours. If rock is encountered within the influence area of the building footprint following stripping and removal of all existing asphalt, concrete, top soil and surficial organic or other deleterious / unsuitable existing materials before reaching the intended design bearing depths, the Contractor shall notify the Owner’s designated On-site Representative and A/E for additional direction before proceeding.

E. Stockpile imported borrow materials and satisfactory excavated soil materials. Stockpile soil materials without intermixing. Place, grade, and shape stockpiles to drain surface water. Cover to prevent windblown dust. Stockpile soil materials away from edge of excavations. Do not store within drip line of remaining trees.

F. Notify the Architect or the Owner's designated On-site Representative and the Testing Agency when excavations have reached required subgrade.

G. The contractor shall follow all excavation safety practices as mandated by 29 CFR Part 1926 (OSHA) and all applicable state and local regulations.

H. Following stripping and removal of all unsuitable or unstable existing materials and excavating to plan working pad elevations within the building pad (building footprint plus a 5 foot nominal buffer, all around), the exposed grades shall be proof-rolled, on a dry day, free of precipitation, in the presence of the Inspecting Professional Geotechnical Engineer (IPGE).

If placement of Select Granular Fill is required to raise the subgrade, the exposed subgrades shall be proof-rolled prior to placement of any required Select Granular Fill.

The proof-roll shall consist of a 5-ton smooth drum roller making 3 overlapping passes in each of two perpendicular directions, on static mode.

These operations shall be performed in the presence of the Inspecting Professional Geotechnical Engineer (IPGE) who will verify satisfactory compaction and conditions have been satisfied.

I. If the Inspecting Professional Geotechnical Engineer (IPGE) and the Testing Laboratory determine that any unsatisfactory, soft, loose, unstable or non-uniform response areas of soil is present, continue excavation and replace with compacted imported granular fill as directed.

1. Additional excavation and replacement material will be paid for according to Contract provisions for changes in the Work.

J. As required, any mass fill procedures performed within the building / equipment pad and influence area shall only commence following completion of the compaction and proof-rolling procedures and receipt of written approval of the subgrade from the Testing Agency's Inspecting Professional Geotechnical Engineer (IPGE).

K. The contractor shall protect all exposed and prepared subgrades and foundation soils against freezing temperatures or frost. The required means and methods of protection shall include, but is not limited to, use of insulating materials as necessary.

L. If required, the Contractor shall reconstruct subgrades damaged by freezing temperatures, frost, rain, accumulated water, or construction activities, as directed by the Architect or the Owner's designated On-site Representative.

M. If on-site silty soils or running sandy soils are encountered during excavation, these soils may become sensitive to water and vibrations from wet weather and normal construction traffic and footing subgrades and slab-on-grade subgrade that expose silty soils will become muddy and will lose integrity in the presence of water and construction traffic. If encountered, the Contractor shall protect and maintain the integrity of all exposed subgrades and shall exercise additional care regarding the exposed silty or running sandy soil subgrades.

In addition to the standard level of care to protect all exposed subgrades and foundation soils against the construction traffic and weather, including protection of soils against freezing temperatures or frost with protective insulating materials as necessary, the Contactor is also responsible for the following to protect and maintain the bearing grades.

N. If necessary to raise the existing grades to achieve planned subgrade elevations, Select Granular Fill material shall be used to raise the grades to the required elevations within the building pad and

influence area. This material shall be placed in nearly horizontal lifts commencing at the lowest fill area elevation and proceed with each lift upward and outward from the lower lift. The compacted lift thicknesses shall not exceed 8-inches in loose thickness or as defined in Article 3.11 "Compaction of Backfills and Fills" with each lift moisture adjusted to within 3% of optimum moisture content and compacted to 95% of maximum dry density as determined by ASTM D1557 (Modified Effort Proctor). Full-time monitoring of the Select Granular fill placement, in-place density testing and measurement of lift thickness is mandatory to verify that all fill placed under this program meets minimum structural requirements and design parameters. When test results indicate insufficient compaction has been obtained in any layer, the Contractor shall take corrective action to modify or alter the moisture content of the soils, to provide additional compaction or otherwise increase the in-place soil density before proceeding with the next lifts. If the Contractor can not obtain satisfactory compaction due to material properties, the Contractor shall remove the unsatisfactory material and replace with new material. Materials contaminated by mud, debris, and/or any other deleterious materials shall be removed and replaced with uncontaminated specified material. Refer to Article 3.11, "Compaction of Backfills and Fills" for in-place density testing requirements before proceeding with subsequent lifts and for additional requirements not specified here.

O. Refer to Contract Drawings for addition information regarding site preparation and approval of subgrades, if required.

3.02 DEWATERING

A. The depths of subsurface water levels will vary by area and will fluctuate based on seasonal and climatic variations, changes in surface runoff patterns, construction activities, and development of the site and the time of year in which construction occurs.

The Contractor shall provide dewatering systems as required to prevent surface water, ground water and subsurface perched water from entering all excavations, from ponding on prepared subgrades, and from flooding the Project Site and surrounding areas.

B. Protect subgrades from softening, undermining, washout, and damage by rain or water accumulation. See Article 3.01, "Preparation" for additional information.

1. Reroute surface water runoff away from excavated areas. Do not allow water to accumulate in excavations. Do not use excavated trenches as temporary drainage ditches.
2. Install a dewatering system to keep subgrades dry and convey ground water away from excavations. It is anticipated that common sump and pump methodology should be able to be used as a satisfactory means and method of temporary dewatering at the Project Site. Sumps shall be strategically located outside the Influence Area of the Foundations and shall be monitored at all times for effectiveness to control water. The Contractor shall maintain these systems until dewatering is no longer required.

3.03 EXPLOSIVES

A. Explosives: Use of explosives, including for removal of Rock, is strictly PROHIBITED.

3.04 EXCAVATION, GENERAL

A. Unclassified Excavation: Excavation to subgrade elevations regardless of the character of surface and subsurface conditions encountered. Unclassified excavated materials may include rock, soil materials and obstructions. No change in the Contract Sum or Contract Time will be authorized for rock excavation or removal of obstructions without written authorization to proceed from the Owner's designated On-site Representative and A/E before proceeding.

1. As indicated in Article 1.01 (General Discussion), to allow for the installation of conventional "Shallow Foundations and Slabs-on-Grade" systems as designed and as shown on the Contract Documents for the Proposed Buildings, the installation of the Specified Ground Improvement System is required to be completely installed and tested under the entire footprint of both the Head Building and the Shed Building prior to the start of the "Building Earth Moving" work required for the construction of these buildings.

2. If excavated materials intended for fill and backfill include unsatisfactory soil materials and rock, replace with satisfactory soil materials.

3. Earth excavation includes excavating pavements and obstructions visible on surface; underground structures, utilities, and other items indicated to be removed; together with soil, boulders, and other materials not classified as rock or unauthorized excavation.

    a. Ram hammering; or ripping of material not classified as rock excavation is earth excavation.

4. Rock excavation includes removal and disposal of rock. Remove rock to lines and grades indicated to permit installation of permanent construction without exceeding the following dimensions.

    a. 24 inches outside of concrete forms other than at footings.
    b. 12 inches outside of concrete forms at footings.
    c. 6 inches outside of minimum required dimensions of concrete cast against grade.
    d. Outside dimensions of concrete walls indicated to be cast against rock without forms or exterior waterproofing treatments.
    e. 8 inches beneath bottom of concrete slabs-on-grade.
    f. 6 inches beneath pipe in trenches, and the greater of 24 inches wider than pipe or 42 inches wide.

3.05 EXCAVATION FOR STRUCTURES

A. Excavate to indicated elevations and dimensions within a tolerance of plus or minus 1 inch. If applicable, extend excavations a sufficient distance from structures for placing and removing concrete formwork, for installing services and other construction, and for inspections.

Refer to Article 3.01 "Preparation" for additional information on preparation of exposed subgrades and to Article 3.06 "Approval and Compaction of Existing Subgrades for Structure Support Foundations" for compaction requirements of exposed subgrades.

1. Excavations for Footings and Foundations: Do not disturb bottom of excavation. Excavate by hand to final grade just before placing concrete reinforcement. Trim bottoms to required lines and grades to leave solid base to receive other work.

    Following excavation to planned subgrade elevations, the exposed subgrades below the building slabs and footings shall be compacted as directed by the Inspecting Professional Geotechnical Engineer (IPGE).

2. Excavation for Underground Tanks, Basins, and Mechanical or Electrical Utility Structures:

Excavate to elevations and dimensions indicated within a tolerance of plus or minus 1 inch. Do not disturb bottom of excavations intended for bearing surface.

3.06 APPROVAL, PROOF-ROLLING AND COMPACTION OF EXISTING SUBGRADES FOR STRUCTURE SUPPORT FOUNDATIONS

A. Notify Architect, Owner's designated On-site Representative, Special Inspector's PGE and Testing Agency when excavations have reached required subgrades.

B. Refer to Article 3.01 "Preparation" and Article 3.05 "Excavation for Structures" for requirements and information on preparation of exposed subgrades and proof-rolling requirements.

C. If the Inspecting Professional Geotechnical Engineer (IPGE) Special Inspector and Testing Laboratory determines that unsatisfactory soil is present, continue excavation and replace with compacted Select Granular Fill as directed.

1. Additional excavation and replacement material will be paid for according to Contract provisions for changes in the Work.

D. Reconstruct subgrades damaged by freezing temperatures, frost, rain, accumulated water, or construction activities, as directed by Architect or Owner's designated On-site Representative.

E. Refer to Contract Drawings for addition information regarding site preparation and approval of subgrades.

3.07 UNAUTHORIZED EXCAVATION

A. Fill unauthorized excavation under foundations or wall footings by extending bottom elevation of concrete foundation or footing to excavation bottom, without altering top elevation. Lean concrete fill may be used when approved by Architect or Owner's designated On-site Representative.

1. Fill unauthorized excavations under other construction or utility pipe as directed by Architect or Owner's designated On-site Representative.

3.08 STORAGE OF SOIL MATERIALS

A. Stockpile imported borrow materials. Stockpile soil materials without intermixing. Place, grade, and shape stockpiles to drain surface water. Cover to prevent windblown dust.

1. Stockpile soil materials away from edge of excavations. Do not store within drip line of remaining trees.

3.09 BACKFILL

A. Place and compact backfill in excavations promptly, but not before completing the following:

1. Construction below finish grade including, where applicable, dampproofing, waterproofing, perimeter insulation, and foundation drainage systems.
2. Surveying locations of underground utilities for record documents.
3. Inspect, compact, and test foundation subgrades. Obtain approval from testing agency.
4. Inspecting and testing underground utilities.
5. Removing concrete formwork.
6. Removing trash and debris.
7. Removing temporary shoring and bracing, and sheeting.

8. Installing permanent or temporary horizontal bracing on horizontally supported walls.

B. Place backfill on subgrades free of mud, frost, snow, or ice.

3.10 SOIL FILL

A. Preparation: The subgrades of areas to receive Select Granular Fill, or backfill materials shall be properly prepared and inspected prior to placement of fill. Refer to Article 3.01, “Preparation” for additional requirements.

B. Fill materials shall be placed on satisfactory and approved subgrade in a manner to minimize segregation. Fill procedures shall only commence after approval of existing subgrades as defined under Article 3.06 “Approval and Compaction of Existing Subgrades for Structure Support Foundations”.

C. Plow, scarify, bench, or break up sloped surfaces steeper than 1 vertical to 4 horizontal so fill material will bond with existing material.

D. Place Soil Fill on subgrades free of mud, frost, snow, or ice.

E. Refer to Article 3.11, “Compaction of Backfills and Fills” for additional requirements.

3.11 COMPACTION OF BACKFILLS AND FILLS

A. General: All filling and backfilling shall be accomplished in a workmanlike manner according to good industry practice. All filling and backfilling shall be installed in a quality-controlled manner with prequalified materials, with quality assurance structural tests and inspections conducted at regular intervals according to the Building Code Chapters 17 and 18, and consistent with the following methodology.

B. The grade to receive Backfill and Fill materials shall be dry, firm and stable, free of mud, water and loose or frozen material. The grade shall be proofrolled, inspected and deemed satisfactory by the Inspecting Professional Geotechnical Engineer (IPGE) prior to placement of fill.

C. Backfill and Fill material shall be placed on satisfactory grade, in a manner to minimize segregation. The backfill and Fill material shall be placed in nearly horizontal lifts commencing at the lowest fill area elevation and proceeding with each lift upward and outward from the lower lift. See Table 2 below for compacted lift thicknesses.

D. The moisture content of the Backfill and Fill material shall be adjusted prior to application of compaction such that it is within 3% of the Optimum Moisture Content. This procedure may involve adding water when the fill material is too dry or discing and aerating to reduce moisture when the fill material is too wet.

E. Place Backfill and Fill soil materials evenly on all sides of structures to required elevations, and uniformly along the full length of each structure.

F. The compacted lift thicknesses and minimum in-place field densities shall conform to the requirements of Table 2 below. Soil in-place density shall be determined using a nuclear density gauge in conformance with ASTM D2922 and D3017. Compact soil materials to not less than the following percentages of maximum dry unit weight according to ASTM D 1557, Modified Effort Proctor:

Table 2: Structural Fill & Backfill Compaction & Lift Thickness Requirements		
Minimum In-Place Density [1]	**Maximum Loose Lift Thickness (inches) [2]**	**Fill Area Description**

95%	8”-10”	Confined areas such as utility trenches and foundation fill / backfill
95%	12”	Mass fill areas and Subbase Course
1. As determine using ASTM D1557, Modified Effort Proctor. 2. Or Compactor manufacturer’s recommended thickness, whichever is less.		

G. When the test results indicate that insufficient compaction has been obtained in any layer, the Contractor shall take action to modify or alter the moisture content of the soil, provide additional compaction or make other adjustments to increase the in-place soil density. If the Contractor cannot obtain satisfactory compaction due to material properties, the Contractor shall remove the unsatisfactory material and replace it with new material.

H. Materials which are frozen, or which include mud, debris, organics or other deleterious materials shall be removed and replaced with clean specified material.

I. No fill shall be placed over an area or lift of fill that has not been tested and achieved satisfactory results.

3.12 MOISTURE CONTROL

A. Uniformly moisten or aerate subgrade and each subsequent fill or backfill layer before compaction to within 3 percent of optimum moisture content.

1. Do not place backfill or fill material on surfaces that are muddy, frozen, or contain frost or ice.
2. The moisture content of the Backfill and Fill material shall be adjusted prior to application of compaction such that it is within 3% of the Optimum Moisture Content. This procedure may involve adding water when the fill material is too dry or discing and aerating to reduce moisture when the fill material is too wet.
3. Remove and replace, or scarify and air-dry, otherwise satisfactory soil material that exceeds optimum moisture content by 3 percent and is too wet to compact to specified dry unit weight.

3.13 GRADING

A. General: Uniformly grade areas to a smooth surface, free from irregular surface changes. Comply with compaction requirements and grade to cross sections, lines, and elevations indicated.

1. Provide a smooth transition between adjacent existing grades and new grades.
2. Cut out soft spots, fill low spots, and trim high spots to comply with required surface tolerances.

B. Grading Inside Building Lines: Finish subgrade to a tolerance of 1/2 inch when tested with a 10-foot straightedge.

3.14 SUBBASE COURSE

A. Under slabs supported on-grade, place Subbase Course on prepared subgrade and as follows. Refer to Article 3.01, “Preparation” for additional requirements.

1. Compact Subbase Course to required cross sections and thickness to not less than 95 percent of maximum dry unit weight according to ASTM D1557.
2. When compacted thickness of Subbase Course is 8 inches or less, place materials in a single layer.

3. When compacted thickness of Subbase Course exceeds 8 inches, place materials in equal layers, with no layer more than 6 inches thick or less than 3 inches thick when compacted.

3.15 FIELD QUALITY CONTROL

A. Testing and Inspecting: Owner will engage a Special Inspector and qualified Testing and Inspecting Agency to perform field tests and inspections and prepare test reports. Refer to Section 01 45 33 “Code-Required Special Inspections and Procedures” for additional information. Sampling and testing for quality control may include those specified in this Article.

B. Allow testing agency to inspect and test subgrades and each fill or backfill layer. Proceed with subsequent earthwork only after test results for previously completed work comply with requirements.

C. Bottom of Footing Subgrades and Slabs-on-Grade Supported on Load Transfer Platform (LTP) Fill: Refer to the Approved Aggregate Pier Submittal for LTP Material Specifications as indicated in Project Specification Section 31 66 13 (Aggregate Piers). The LTP is associated with the required Delegated Design of the Ground Improvement System with Aggregate Piers and Load Transfer Platforms (LTPs).

1. See Article 1.06, “Definitions”, for additional information.
2. See Article 2.04, “Soil Materials”, for additional information
3. Refer to the Structural Contract Drawings for additional information regarding the Building Pad Site Preparation / Ground Improvement General Notes and the Building Foundation system and design parameters.

D. Testing agency will test compaction of soils in place according to ASTM D 1556, ASTM D 2167, ASTM D 2922, and ASTM D 2937, as applicable. Tests will be performed at the following locations and frequencies:

1. Building Pad Areas (Open Areas): At subgrade and at each compacted fill and backfill layer, at least 1 test for every 2500 sq. ft. or less of paved area or building pad, but in no case fewer than 3 tests.
2. Foundation Wall Backfill (trenched / restricted areas): At each compacted backfill layer, at least 1 test for each 30 feet or less of wall length, but no fewer than 2 tests.
3. Trench Backfill (restricted areas): At each compacted initial and final backfill layer, at least 1 test for each 30 feet or less of trench length, but no fewer than 2 tests.

E. When testing agency reports that subgrades, fills, or backfills have not achieved degree of compaction specified, scarify and moisten or aerate, or remove and replace soil to depth required; recompact and retest until specified compaction is obtained.

3.16 PROTECTION

A. Protecting Graded Areas: Protect newly graded areas from traffic, freezing, and erosion. Keep free of trash and debris.

B. Repair and reestablish grades to specified tolerances where completed or partially completed surfaces become eroded, rutted, settled, or where they lose compaction due to subsequent construction operations or weather conditions.

1. Scarify or remove and replace soil material to depth as directed by Architect or Owner's designated On-site Representative; reshape and recompact.

C. Where settling occurs before Project correction period elapses, remove finished surfacing, backfill with additional soil material, compact, and reconstruct surfacing.

1. Restore appearance, quality, and condition of finished surfacing to match adjacent work, and eliminate evidence of restoration to the greatest extent possible.

3.17 DISPOSAL OF SURPLUS AND WASTE MATERIALS

A. Disposal: Remove surplus soil and waste material, including unsatisfactory soil, trash, and debris, and legally dispose of it off Owner's property.

END OF SECTION

SECTION 31 22 01
SITE EARTHWORK

PART 1 - GENERAL

1.01 DESCRIPTION OF WORK

A. The extent of site earthwork and site grading is shown on the drawings. (Refer to Building Earthwork for earthwork requirements within the building foundation limits).

B. Site earthwork includes, but is not limited to, the following:

1. Fill Materials
2. Source Quality Control
3. Shoring, Bracing and Supporting
4. Horizontal and Vertical Layout
5. Grading and Excavation
6. Compacted Backfill and Fill
7. Field Quality Control Testing and Inspection Services
8. Guarantee
9. Clean Up

C. Provide materials, labor, equipment and services required to accomplish related work in accordance with the drawings and specifications.

1.02 RELATED WORK SPECIFIED ELSEWHERE

A. Section 003132 - Subsurface Investigation Information/ Geotechnical Report

B. Section 311201 - Site Preparation

C. Section 312300 - Building Earthwork

D. Section 312501 - Erosion, Sediment and Pollution Control

E. Section 334001 - Storm Drainage

1.03 REFERENCES

A. AASHTO T 180 - Standard Specification for Moisture-Density Relations of Soils Using a 4.54 kg (10-lb) Rammer and a 457 mm (18 in.) Drop, American Association of State Highway and Transportation Officials

B. ASTM C 136 - Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates.

C. ASTM D 75 - Practice for Sampling Aggregates

D. ASTM D 422 - Particle-Size Analysis of Soils (without Hydrometer Analysis)

E. ASTM D 698 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft3)

F. ASTM D 1557 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft3)

G. ASTM D 2434 - Standard Test Method for Permeability of Granular Soils (Constant Head)

H. ASTM D 2487 - Standard Practice for Classification of Soils for Engineering Purposes (Unified Soil Classification System)

I. ASTM D 2922 - Standard Test Methods for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth)

J. ASTM D 3017 - Standard Test Method for Water Content of Soil and Rock in Place by Nuclear Methods (Shallow Depth)

K. ASTM D 6938 - In Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods

L. ASTM D 4318 - Standard Test Methods for Liquid Limit, Plastic Limit, and Plasticity Index of Soils

M. ASTM D 5084 - Standard Test Method for Measurement of Hydraulic Conductivity of Saturated Porous Materials Using a Flexible Wall Permeameter.

N. Deep Ripping and Decompaction shall be per NYSDEC recommendations, latest edition

O. Occupational Health and Safety Administration Regulations and Standards

P. American Sports Builders Association (ASBA): Sports Fields - A Construction and Maintenance Manual, latest edition.

Q. ASTM F2898-11 – Standard Test Method for Permeability of Synthetic Turf Sports Field Base Stone and Surface System by Non-Confined Area Flood Test Method

1.04 SUBMITTALS (See Section 311201, 1.5)

A. Furnish name of New York State licensed Land Surveyor to be employed and perform project layout. Obtain Architect's approval prior to performing work.

B Submit written report on NYS licensed Land Surveyor's letterhead verifying that professional's involvement with the project layout. The report shall briefly state the scope of services performed for the project, the dates work was accomplished, and an explanation of any adjustments required, specifically listing as-built and FIELD VERIFY requirements as noted in 3.2 of this specification section.

C. Provide Earthwork Contractor's experience requirements as indicated in 1.5, "Quality Assurance". Obtain Architect's approval prior to performing work.

D. Samples: 10 lb. samples of each type of fill; submit in airtight containers to testing laboratory.

E. Materials Sources: Submit name of imported materials source for each type of fill material.

F. Fill Composition Test Reports (Imported and Onsite): Provide results of laboratory tests (less than 2 months old) on proposed and actual materials used to determine acceptability. This shall include:

1. One optimum moisture-maximum density curve (Modified Proctor) for each soil/imported fill type as determined by ASTM D1557, Method A, latest issue.
2. Sieve Analysis - ASTM D422
3. Moisture Density Relationship - ASTM D1557, Method C / ASTM D698
4. Plasticity Index - ASTM D4318
5. Soundness Test - ASTM C88
6. Soil Classification - AASHTO and ASTM D2487

G. Compaction Density Test Report(s) required in Field Quality Control of this specification.

H. Contractor's NYS Licensed Professional Engineer's layout and design calculations of sheet piling and shoring required.

1.05 QUALITY ASSURANCE

A. Perform all site earthwork, site grading and excavation in compliance with requirements of governing authorities having jurisdiction, OSHA Standards, and "References" in this project specification.

B. The Owner will employ a licensed soil testing and inspection service for Field Quality Control Testing of materials. This Contractor will coordinate day to day scheduling with the Owner's testing agency for conformance with "Field Quality Control Testing and Inspection Services" in this project specification.

C. Earthwork Contractor Experience Requirements: Submit business name, business Owner(s) name(s), business address, telephone number, website and/or email address signed by the Contractor/Subcontractor who meets the qualifications set forth in this specification and is proposed by the Contractor to perform the Earthwork for this Project. Provide a list of at least four (4) Earthwork projects of comparable size, scope and quality completed successfully by the proposed Contractor/Subcontractor within the past three (3) years that includes the date completed, project Owner's name and current contact information, including telephone numbers and email addresses.

D. Layout Foreman Experience: The Earthwork Contractor must provide a competent layout foreman skilled in this specific type of layout/earthwork project. The layout/earthwork foreman shall have a minimum of four (4) similar projects completed within the last three (3) years. Provide a list of projects layout/earthwork foremen has completed including project name, address, Owner contact information and project scope of work.

1.06 JOB CONDITIONS

A. Job conditions in Section 311201 apply.

B. Provide sufficient quantities of fill materials to meet project schedule and requirements. When necessary, store materials on site in advance of need.

C. When fill materials need to be stored on site, locate stockpiles where directed by Owner.

1. Separate differing materials with dividers or stockpile separately to prevent intermixing.

2. Prevent contamination of material types.

3. Protect all stockpiles from erosion and deterioration of materials by covering with plastic sheets, tarps or as directed by the Architect.

D. Moisten or dry, fill or backfill materials, to the proper moisture content as determined in accordance with ASTM D1557, Method C in order to obtain proper compaction as indicated.

1.07 SUB-SURFACE SOIL INFORMATION

A. Refer to subsurface information elsewhere in the specifications. The geo-technical data on subsurface conditions is not intended as representation warranties of the continuity of such conditions between test pits or test borings made by the Owner and included in the specification. It is expressly understood that the Owner, Architect, Landscape Architect, and Consulting Engineers are not responsible for interpretations or conclusions drawn therefrom by the Contractor. The data is made available for the convenience of the Contractor.

B. Additional test borings and other exploratory operations may be made by the Contractor at no additional cost to the Owner, provided such operations are acceptable to the Architect and Owner. Coordinate test locations with Owner prior to starting work. Backfill immediately when completed and repair to satisfactory conditions as determined by the Architect. It is expressly understood that the Owner, Architect, Landscape Architect, and Consulting Engineers are not responsible for interpretations or conclusions drawn therefrom by the Contractor.

1.08 UNUSUAL SUBSURFACE CONDITIONS

A. Notify the Architect immediately in writing via email when unusual conditions are encountered during excavation, including, but not limited to excessive flooding, miscellaneous structures, uncharted or unlocated utilities, foundations, bed rock, toxic and hazardous materials and chemicals, suspected archaeological artifacts, and unsatisfactory soil materials. Request clarification from the Owner's Representative or Architect before proceeding. Refer to paragraph 3.4 of this specification.

B. Contaminated Soils:

1. If contaminated soil materials, as determined by the Geo-Technical Engineer, are encountered at design elevations, immediately notify the Architect and cease work in that area. The Owner will employ a testing agency to verify the contamination type, limits of contamination and treatment approach.

2. Refer to Geotechnical Report for Environmental Assessment Information.

PART 2 -PRODUCTS

2.01 FILL MATERIALS

A. **Satisfactory General Earth Fill: (for site work only)**

1. To be used at least 5'-0" outside of structural elements, retaining walls, building foundations

2. Satisfactory general earth fill shall be satisfactory on-site subsoil, or hauled in off-site subsoil free of toxics, hazardous wastes and chemicals that may be injurious to humans, animals and plant materials. Satisfactory earth fill shall also be free of rubbish, debris, wood, masonry, metal, frost, vegetation, organics or other deleterious material, which cannot be properly compacted. Use satisfactory

general earth fill that is dry and free of clay. Rocks, gravel or soil shall not be larger than 3" in any dimension/direction.

3. Satisfactory earth fill materials are also defined as those complying with the American Association of State Highway Transportation Officials (AASHTO), M-145 soil classification Groups A-1, A-2-4, A-2-5, A-3 and Unified Soil Classification System GW, GP, GM, GC, SW, SP, SM, and SC (or a combination of these group symbols) as determined by ASTM D2487.

B. **Imported Granular Backfill: (for sitework only)**

1. Imported granular backfill to be used for asphalt pavement subbase, concrete subbase, storm structures, storm pipes, water pipes, sanitary manholes, sanitary pipes, other structures, and where indicated on the drawings.

2. Backfill shall be **run of crusher limestone** meeting the following gradation as determined by ASTM-C136:

Standard Sieve Sizes	Percent Passing By Weight
2" or 50 mm	100%
3/4" or 19 mm	75 - 90%
1/4" or 6.3 mm	25 - 60%
#40 or 0.425 mm	5 - 40%
#200 or 0.075 mm	0 - 8%

3. Backfill shall be free of debris and deleterious materials. In no case shall the plasticity index exceed 5.0 or the percentage passing the 200-mesh sieve exceed 8%. The quality of the imported granular backfill shall be determined by the magnesium sulfate soundness test, if considered suspect by the Architect or Geotechnical Engineer. The maximum percent loss at four cycles by weight shall be 20.

C. **Imported Structural Fill: (for site work only)**

1. Imported structural fill to be used in areas of structural elements, for top eight (8") inches of design subgrade elevation for running track, field events, tennis courts, synthetic turf fields and where noted on the drawings.

2. Shall be **run-of-bank or run-of-crusher gravel** free from organic matter or other deleterious materials, meeting the material gradation requirements of Item 304.05 Sub-base Course, Type 4, of the NYSDOT's Standard Specifications for Construction Materials, as determined by ASTM C136.

Standard Sieve Sizes	Percent Passing By Weight
2" or 50 mm	100%
1/4" or 6.3 mm	25 - 60%
#40 or 0.425 mm	5 - 40%
#200 or 0.075 mm	0 - 8%

3. Imported structural fill shall be accepted on the basis of gradation, soundness, plasticity index and a well-defined Moisture-Density Relationship Curve. Imported structural fill to be placed within 8" of final exterior subgrade shall be subject to Soundness requirements. Soundness shall be less than 30% loss

based on a four-cycle magnesium sulfate soundness test. Plasticity Index of that portion of fill material passing the No. 40 mesh sieve shall not exceed 5.0.

D. **Stormwater Management Trench (SMT) Backfill:**

1. Shall be No. 1 clean, washed, crushed stone or crushed gravel meeting the following gradation as determined by ASTM C136:

Standard Sieve Size	Percent Passing By Weight
1" or 25.0 mm	100%
1/2" or 12.5 mm	90-100%
1/4" or 6.3 mm	0-15%

E. **Retaining Wall(s) Backfill:**

1. Shall be run-of-crusher hard durable limestone having a gradation by weight in accordance with ASTM C-136, within the following limits:

Standard Sieve Sizes	Percent Passing By Weight
2" or 50 mm	100%
3/4" or 19 mm	75 - 90%
1/4" or 6.3 mm	25 - 60%
#40 or 0.425 mm	5 - 40%
#200 or 0.075 mm	0 - 2%

2. Backfill shall be free of debris and deleterious materials. In no case shall the plasticity index exceed 5.0 or the percentage passing the 200-mesh sieve exceed 2%. The quality of the retaining wall backfill shall be determined by the magnesium sulfate soundness test, if considered suspect by the Architect or Geotechnical Engineer. The maximum percent loss at four cycles by weight shall be 20.

2. Material shall have a permeability of 2.4"/hour (1.7 x 10-3 cm/s) or greater when compacted to required density.

F. **Topsoil:**

1. Imported topsoil, (borrow). Refer to SECTION 329001 - Planting and SECTION 329201 - Lawns for topsoil requirements.

2. Existing topsoil: Best available salvaged.

2.02 UNSATISFACTORY SOIL MATERIALS

A. Shall be defined as soil with high percentage of decomposed rock, sand, organic matter or moisture laden clay to prevent adequate compaction. Also, soil with toxics, hazardous wastes and chemicals (such as atrizene and muriatic acid) that may be injurious to humans, animals and plant materials. Also, soil with significant quantities of rubbish, debris, wood, masonry, metal, frost or other deleterious material which, in the opinion of

the Geotechnical Engineer, Owner's Representative, and Architect, cannot be properly compacted shall be classified as unsatisfactory.

B. Unsatisfactory soil materials are defined as those described in AASHTO M-145, soil classification, Groups A-2-6, A-2-7, A-4, A-5, A-6, and A-7 with CBR value less than 7.0. Also Unified Soil Classification System ML, CL, OL, MH, CH, OH as determined by ASTM D2487 (or a combination of these group symbols) with CBR value less than 7.0 in addition to peat (PT) and other highly organic soils, cobbles, boulders; and soil materials, of any classifications that have a moisture content at the time of compaction beyond the range of 1% below and 3% above the optimum moisture content of the soil material/backfill material, as determined by the Moisture Density Relationship test.

C. When unsatisfactory soil materials are encountered at proposed subgrades and other design elevations, proceed as described in Part 3 (Execution) of this Section.

D. When excavated materials become unsatisfactory as a direct result of the Contractor's work, this shall result in the rejection of the unsatisfactory soil materials by the Architect.

E. The use of slag (a byproduct of metal processing) or recycled/crushed concrete is unacceptable for any use on this project site.

2.03 SOURCE QUALITY CONTROL

A. See "Submittals" and "Quality Assurance" of this specification section for general requirements for testing and analysis of soil and fill materials.

B. Where fill materials are specified by reference to a specific standard, Contractor is responsible to test and analyze all samples for compliance before delivery to site.

C. If tests indicate materials do not meet specified requirements, change material and retest until approved.

2.04 SHORING, BRACING AND SUPPORTING

A. Shoring and bracing shall conform to the requirements of the Occupational Health and Safety Act.

B. Shoring and bracing shall be provided, placed and maintained at the locations and elevation that are necessary or required to: support and protect the sides and bottom of the excavation; prevent undue disturbance or weakening of the supporting materials below or beside the works; prevent movement of ground which may disturb or damage the work, adjacent pavements, property, structures or other works.

C. Provide materials for shoring, bracing and supporting, such as sheet piling, uprights, sheathing, stringers and cross-braces, in good serviceable condition. Use timbers that are sound and free of large or loose knots.

D. Provide design by Contractor's NYS Licensed Engineer, when shoring is required to perform work as shown on the drawings. Submit to Architect for approval.

E. Installation: Shoring and bracing shall be driven and placed so that it can be removed as backfilling takes place without damage to the pipeline or its appurtenances, structures, and without settlement of or damage to adjacent pavements and structures.

F. Removal: The Contractor shall remove all shoring and bracing as the excavation is backfilled, unless directed by the Architect to be left in place. The procedure for

extracting shoring and bracing and placing backfill shall ensure the backfill load is applied gradually, and disturbance of the works or foundation material is avoided.

G. Support all utilities as required by the municipality/utility owner.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify field conditions such as bench marks, monuments, topography, inverts, locations of utilities and property lines before proceeding. Notify the Architect immediately, in writing, of discrepancies prior to commencing work. Commencement of work will be construed as complete acceptance of survey and layout information. Additional costs resulting from failure to verify field conditions prior to commencing work shall be borne by this Contractor and at no additional cost to the Owner.

3.02 LAYOUT

A. Stake layout up to and including those elevations and dimensions specifically noted on drawings as "FIELD VERIFY" (FV). Ensure that the field elevation and dimension agree with the elevation and dimension on the drawings before continuing. Notify the Architect immediately, in writing, of any discrepancies prior to commencing work. Additional costs resulting from failure to verify dimensions as noted on drawings shall be borne by this Contractor and at no additional cost to the Owner.

1. Assume sole responsibility for the accuracy of the layout work.

2. Run from point(s) of beginning (POB), base lines, property monuments, bench marks, iron survey pins, or other points given on the drawings.

3. Roads, Parking Areas, and Walks: Accurately locate and stake curb lines, center line, swales, point of curve and tangency as necessary to accurately build.

4. Buildings and Site Features: Accurately locate and stake corners, offset corners, slopes, and center lines as necessary to accurately build.

5. Pipe Work: Accurately locate with laser.

3.03 GRADING

A. Cut and Fill: Presume the earthwork does **NOT** balance on site. Meet the grades shown on the drawings. Haul in or haul away as may be necessary. Provide earthwork calculations and provide for imported or exported material as part of bid. No additional costs will be allowed.

B. Grade areas as indicated, including transition areas, with uniform levels and slopes between finish elevations.

C. Cut to grades and profiles indicated.

D. Set grade stakes at fifty-foot (50') intervals, at corners, and breaks in grade.

E. Conduct operations to avoid ponding of water. Provide all pumping equipment, sump pits, and temporary diversion swales where and when necessary to continue work performance on schedule and as specified.

F. Shape subgrade surface of site elements to within 0.10' above or below required subgrade elevation, compacted as required and sloped to provide drainage as shown on the drawings. Notify Architect and Geo-Technical Engineer for subgrade review prior to continuing work.

G. Shape subgrade surface of athletic fields and track/tennis courts areas using laser plane control system for grading of subgrade elevation to ensure accuracy in grade tolerances of +0" to - ¼" in 10' any direction. Compact as required and sloped to provide drainage as shown on the drawings. Notify Architect and Geo-Technical Engineer for review prior to continuing work.

H. Refer to Section 311201 for topsoil requirements.

3.04 EXCAVATION

A. Remove and legally dispose of material encountered to obtain required subgrade elevations, including pavement, obstructions visible on ground surface, underground structures and utilities indicated to be removed.

B. Sloping and Benching: Follow OSHA recommendations based on soil type to determine slope configurations. Slope the sides of excavations five (5') feet deep and over to the angle of repose of the material excavated; otherwise, shore, and brace where sloping is not possible either because of space restrictions or stability of material excavated.

C. Bracing and Shoring:

1. Provide bracing and shoring as required in excavations, to maintain sides and to protect structures from settlement.

2. Maintain shoring and bracing in excavations regardless of the time period excavations will be open. Carry down shoring and bracing as the excavation progresses.

3. Remove shoring and bracing before completion of backfilling except where required for structural support or slope stability.

4. The design, installation, and maintenance of such shoring and bracing required to accomplish the above purpose are the sole responsibility of the Contractor.

5. Follow OSHA recommendations for bracing and shoring.

6. Indemnify the Owner, the Landscape Architect, Architect, and the Consulting Engineers against any action arising from damage to existing structures, utilities or injury to persons resulting from the Contractor's actions or failure to act, in carrying out the intent of this section.

D. Protections: Protect structures, vegetation, utilities, sidewalks, pavements, and other facilities in areas of work. Barricade and secure open excavations and provide warning lights/signage from dusk to dawn each day.

E. Extent of Excavations: Excavate for structures to elevations and dimensions shown, extending excavation a sufficient distance to permit placing and removal of other work and for review. Trim bottom to required lines and grades to provide solid base to receive concrete or imported granular backfill material.

F. Unsatisfactory Soil Materials: When unsatisfactory soil materials, as defined in this specification, are encountered at design elevations, immediately notify the Architect in writing by email or other equally expeditious means. Continue as directed by the Architect and Geo-Technical Engineer. When, in the sole opinion of the Architect, conditions are not a result of Contractor's negligence, additional excavation may be directed by the Architect and paid for as a Change Order on a unit price or negotiated price basis in accordance with Contract Documents. This additional excavation shall be measured each day and verified by the Owner's representative and the Contractor's Superintendent. A daily written accounting, attested by both parties, shall be maintained with copies daily to the Architect. No claim for extra compensation will be considered except through the procedure outlined above. **Assume 200 CY (two-hundred cubic yards) of undercutting and removals, placement of soil stabilization fabric (SSF) and providing and compacting to 95% density imported granular backfill material in Base Bid.** Unit price provided shall be utilized to add to or delete from this assumed quantity to account for actual quantity encountered.

G. Unauthorized and Over Excavation: Consists of removal of materials beyond required subgrade elevations or dimensions without specific direction of the Architect or Geotechnical Engineer. Unauthorized or over excavation, as well as remedial work directed by the Architect or Geotechnical Engineer, shall be at Contractor's expense. Fill of unauthorized excavations shall be as follows (all at no additional cost to the Owner):

1. Fill the voids created by the removal of materials beyond indicated subgrade elevations with lean concrete (2000 psi). Or;

2. Extending the indicated bottom elevation of the concrete footing to the lower elevation. Or;

3. Adding imported granular backfill material compacted to 95% density to proper design elevation and layout as directed by the Architect. Testing agency to perform compaction testing prior to proceeding.

H. Dewatering:

1. Contractor shall anticipate seasonal variations of soil moisture content and groundwater in the Base Bid as verified by site investigation indicated in Section 311201.

2. Prevent surface water and ground water from entering excavations, from ponding on prepared subgrades, and from flooding Project site and surrounding area.

    a. Surface and ground water shall be intercepted and removed before entering excavations. All necessary measures shall be taken. Earth dikes, ditches, or other devices, if required, shall be constructed to prevent such flows.

3. Protect subgrades from softening, undermining, washout, and damage by rain or water accumulation.

    a. Reroute surface water runoff away from excavated areas. Do not allow water to accumulate in excavations. Do not use excavated trenches as temporary drainage ditches.

    b. Remove water to prevent softening of foundation bottoms, undercutting footings, and soil changes detrimental to stability of subgrades and foundations.

c. Provide and maintain pumps, sumps, suction and discharge lines, and other dewatering system components necessary to convey water away from excavations.

4. The Contractor shall at all times provide and maintain proper and satisfactory means and devices (i.e. ditches, temporary pipes, pumps, and/or other temporary construction) for the removal of all water entering the excavations. Water shall be removed as fast as it may collect, in such manner that shall not interfere with the execution of the work or in the proper placing of pipe, structures or other work.

5. Provide and operate sufficient pumping machinery to keep excavated parts free of water. Dig sump pits when necessary into which the excavation shall be drained. Take care and proper precautions in the use of pumps so that in no case will foundations, footings and utilities already in place or existing foundations, footings of adjacent structures or utilities be undermined or disturbed, and erosion occur due to pumping.

6. Do not discharge pumped materials into any body of water, wetland, adjacent property, roadside swales, subsurface storm systems, or any infiltration practices as determined by the Architect. Provide temporary sediment basins, traps, and filter bags for pumped water.

7. Adjust, repair, replace, or clean all work, surfaces, and property, which may have been affected as a result of any dewatering operation.

8. Contaminated groundwater shall be collected at the discretion of the Engineer in accordance with Sections 02 61 00.20 and 02 65 00.20.

I. Prepare subgrade and twelve (12") inches of existing sub-soils below subgrade elevations in excavated areas to minimum density of 95% in structure, pavement, utility areas, trenches, and 90% under lawn non-paved areas.

J. Rock and Rock Excavation:

1. Rock Definition: Shall be defined as solid hard material located in ledges, bedded aggregate deposits and unstratified masses, and all-natural conglomerate deposits so firmly cemented as to present all the characteristics of solid rock, which must be removed by pneumatic hammers. Rock <u>does not include</u> rip-able shale, slate, soft sandstone, hardpan, masonry or concrete rubble, boulders less than three (3) cubic yards, such other rock material which is decomposed, stratified, weathered or shattered, or any material that requires pneumatic hammers, ripping or excavating equipment larger than defined for common excavation .

2. Rock Excavation Administrative Procedures: When encountered, shall be stockpiled for measurement before removal and paid for by approved Change Order accordance with Contract Documents. Notify Architect immediately of rock discovery prior to performing any rock removal or continued excavation. Rock excavations as defined shall be measured each day and verified by the Owner's designated representative and the Contractor's on-site Superintendent. A daily written accounting, attested to by both parties, shall be maintained with copies daily to the Architect. No claim for extra compensation will be considered except through the procedure outlined above.

3. Rock Excavation Removal Procedures: Includes removal and disposal of rock. Remove rock to lines and grades indicated to permit installation of permanent construction without exceeding the following dimensions.

   a. 24 inches outside of concrete forms other than at footings.

   b. 12 inches outside of concrete forms at footings.

   c. 6 inches outside of minimum required dimensions of concrete cast against grade.

   d. Outside dimensions of concrete walls indicated to be cast against rock without forms or exterior waterproofing treatments.

   e. 8 inches beneath bottom of concrete slabs-on-grade.

   f. 6 inches beneath pipe in trenches, and the greater of 24 inches wider than pipe or 42 inches wide.

4. Any over excavation due to rock excavation and removal shall be handled as directed under "Over Excavation" in this Section.

5. Contractor has the option to remove existing rock and dispose off-site or crush existing rock and use as satisfactory general earth fill when it meets gradation noted in 312201 for imported granular backfill material.

3.05 BACKFILL AND FILL

A. Preparation of Ground Surface to Receive Fill: Remove vegetation, organic materials, obstructions, and deleterious materials from ground surface prior to placement of fills. Break up and remove existing foundations, concrete slabs, abandoned utilities, and site features. Plow, strip, roughen, or break up slopes' steeper than 1 vertical to 4 horizontal so that fill material will bond to existing surface.

B. Execute these steps when the existing ground surface, after removal of the above unsatisfactory soil materials, has a density less than that specified under "Compaction" for the particular area classification: Break up the ground surface, pulverize, moisture-condition to the optimum moisture content, and compact to the required depth and percentage of maximum density.

C In no case shall fill be placed on a subgrade that is wet, muddy, rutted, spongy, frozen or that contains frost or that has not been tested and approved to achieve satisfactory results.

D. Areas to receive any fill or backfill should be properly prepared, proof rolled, tested per "Field Quality Control" within this specification, inspected and approved by the Architect and Geo-Technical Engineer prior to the placement of fill.

E. Following grade approval by the Architect and Geo-Technical Engineer, place imported granular backfill, imported structural fill and satisfactory general earth fill material in layers not more than eight (8") inches in loose depth in a manner to minimize segregation. The fill shall be placed in nearly horizontal lifts commencing at the lowest fill area elevation and proceeding with each lift upward and outward from the lower lift.

F. Moisture Content: Contractor shall anticipate seasonal variations of all soils (on site or imported) and imported fills moisture content in the Base Bid and timing required for such

shall be included in the project schedule. The moisture content of the materials shall be adjusted prior to application of compaction such that it is no more than 1% below or 3% above the optimum moisture content of the material. Apply water to surface, subgrade or layers of soil material when required to achieve compaction densities stated below. Remove and replace, or scarify and air dry, soils or imported materials that is too wet to permit compaction to specified density.

G. Compaction:

1. Compact each eight (8") inch layer of fill and backfill materials.

2. Compact fill and backfill material below subgrade for structures, slabs, pavements, and utilities to minimum 95% of optimum in place density as determined by ASTM D1557, Modified Proctor.

3. Compact fill material below subgrade for lawns or unpaved areas to minimum 90% of optimum in place density as determined by ASTM D1557, Modified Proctor.

H. Equipment:

1. Use sheepsfoot rollers, pneumatic tired rollers, drum rollers, vibrating tampers, and other compaction equipment capable of obtaining the required density throughout the entire layer being compacted.

2. Use power-driven hand tampers for compacting materials adjacent to site structures.

3. For utility trenches or other confined areas, small compaction equipment may be necessary such as a vibratory plate, jumping jack or walk-behind vibratory roller. In these cases, lift heights no greater than six (6") inches should be maintained.

I. Reconditioning Compacted Areas: Where previously completed compacted areas are disturbed by subsequent construction operations (by any Contractor), traffic or adverse weather, scarify and dry out the surface, regrade, and recompact to the required density prior to further construction at no additional cost to the Owner. Use hand tamping for re-compaction over underground utilities and trenches.

3.06 FIELD QUALITY CONTROL TESTING AND INSPECTION SERVICES

A. Soil Testing Service/Geo-Technical Engineer must inspect and approve density tests, retesting, and proof rolling of subgrades, as described in this section, before further construction work is performed thereon.

B. Perform compaction density testing on compacted fill and imported granular base course in accordance with ASTM D1556, ASTM D1557, ASTM D2922, and D3017.

C. In place density testing should be performed at a frequency of one (1) test per 500 square feet per lift in smaller open areas, one (1) test per 2,500 square feet per lift in larger open areas, and one (1) test per 25 feet per lift in confined areas and utility trenches.

D. When the test results indicate that insufficient compaction has been obtained in any layer, the Contractor shall take action to modify or alter the moisture content in the soil, to provide additional compaction and testing or otherwise to increase the in-place soil density. If the Contractor cannot obtain satisfactory compaction due to material

properties, the Contractor shall remove the unsatisfactory material and replace with new material at no additional cost to the Owner.

E. Materials contaminated by mud, debris, organics, frost, and/or other deleterious materials shall be removed and replaced with uncontaminated specified material.

F. No fill or backfill shall be placed over an area or lift of fill that has not be tested and achieved satisfactory results.

G. Proof Rolling: On pavement subgrades, unless otherwise directed by the Architect, the only testing required will be the proof rolling as described below:

1. Provide Soil Testing Service/Geo-Technical Engineer with 48-hour advance notification when subgrades are ready to proof roll.

2. Proof Roll the prepared pavement subgrade surface with fully loaded ten (10 c.y.) cubic yard earth moving truck or, in the opinion of the Architect/Geo-Technical Engineer, using a 5-ton smooth drum roller making at least 3 overlapping passes, in each of 2 perpendicular directions, on static mode at a speed of 1 to 4 feet/second. Check for unstable areas. Subgrades that rut, pump or deflect under the truck's tires may be judged unstable by the Architect/Geo-Technical Engineer. These areas may require further compaction or undercutting as directed by the Soil Testing Service/Geo-Technical Engineer.

3.07 GUARANTEE

A. Guarantee concrete slabs, pavements, curbs, retaining walls, trenches, utilities, flagpoles, structures, lawns, and plant materials free from settlement for a period of one (1) year from the date given on the certificate of substantial completion or final punch list when satisfactorily completed and accepted by the Architect, whichever is later.

B. Repair to proper grade and alignment any and all settlement of concrete slabs, pavements, curbs, retaining walls, trenches, utilities, flagpoles, structures, lawns and plant materials adversely affected by settlement within one (1) year after date given on the certificate of substantial completion or final punch list when satisfactorily completed and accepted by the Architect, whichever is later, at no additional expense to the Owner. In damaged compacted areas, scarify the surface, re-shape, and compact to required density prior to further construction.

C. All repairs/corrections shall be completed to the satisfaction of the Owner within seven (7) days of written notice by the Owner.

3.08 CLEAN UP

During the contract and at intervals as directed by the Architect and as earthwork is completed, clear the site of surplus earth, large surface stones, debris, tools and equipment. Leave the site in a clean, safe, well draining, and neat condition.

END OF SECTION 31 22 01

SECTION 31 25 01
EROSION, SEDIMENT AND POLLUTION CONTROL

PART 1 - GENERAL

1.01 DESCRIPTION OF WORK

A. Provide erosion, sediment and pollution controls as shown on the drawings and as directed by the Architect to significantly reduce runoff on downstream and neighboring properties. This includes temporary control measures to mitigate land disruption by other Contractors during construction of this project.

B. Erosion, sediment and pollution control includes, but is not limited to, the following:

1. Storm structure protection
2. Silt fence
3. Off site sediment tracking controls
4. Temporary concrete washout facility
5. Temporary seeding and mulching
6. Permanent seeding
7. Straw mat
8. Temporary sediment filter bag for pumped water
9. Fiber roll (Straw wattle)
10. Construction site dust control
11. Spill prevention, reporting and documentation
12. Clean up

C. Provide materials, labor, equipment and services required to accomplish related work in accordance with the drawings and specifications.

D. Code Compliance: The New York State Department of Environmental Conservation requires a SPDES General Permit for Storm Water Discharges from Construction Activity. This Permit GP-0-20-001 is pursuant to the Environmental Conservation Law and has penalties and fines related to violations.

1.02 RELATED WORK SPECIFIED ELSEWHERE

A. Section 311201 - Site Preparation

B. Section 312201 - Site Earthwork

C. Section 329201 - Lawns

D. Section 334001 - Storm Drainage

1.03 REFERENCES

A. Spill Guidelines Manual (SGM) New York State Dept. of Environmental Conservation.

B. New York State Standards and Specifications for Erosion and Sediment Control, dated July 2016 or latest edition.

1.04 SUBMITTALS: (See Section 311201, 1.5)

A. Manufacturer's Data (MPD) are required for:

1. Filter Fabric for Storm Structure Protection
2. Silt Fence with Net Backing
3. Soil Separation Fabric for Off Site Sediment Tracking Control
4. Sediment Filter Bag
5. Straw Mat
6. Fiber Roll
7. Spill Response Equipment

B. Material Certificates (MC) showing content/mechanical analysis and Samples are required for:

1. No. 3 Stone for Off Site Sediment Tracking Control
2. Temporary Seeding and Mulching: Submit seed mix species and mulch source
3. Permanent Seeding & Sodding: (See Section 329201)

C. Certification Statement: Submit photocopy of Section 312501, 1.7, filled out completely and accurately to the Landscape Architect at the pre-construction meeting.

D. Listing of emergency contract numbers. This list shall include the name of an Emergency Response Contractor that may be used in certain situations.

E. Per NYSDEC SPDES Regulations, all onsite contractors performing earth disturbing activities need to have current NYSDEC endorsed 4-hour erosion and sediment (E&SC) training. Provide copies of all onsite personnel certification cards, prior to construction. The document shall be kept on file (by the Contractor) within the onsite SWPPP log book.

1.05 QUALITY ASSURANCE

A. Perform erosion, sediment and pollution control in compliance with applicable requirements of the New York Standards and Specifications Erosion and Sediment Control Manual, dated July 2016 (or latest edition) or other governing authorities having jurisdiction.

B. Prevention of erosion and pollution from storm water runoff for the duration of this project is the responsibility of this Contractor. All Storm Water Pollution Prevention control work indicated on the drawings and/or specifications shall be included in this Contractor's Base Bid. Damages resulting from, but not limited to, negligence, improper maintenance or general disregard for erosion control measures shall be immediately corrected by this Contractor to the satisfaction of the Landscape Architect, Engineer, or Certified Erosion Control Specialist hired by the Owner for SWPPP inspections as required by NYSDEC. Damages resulting from other contractors shall be repaired by this Contractor on a time and materials basis and back charged to the responsible party. Any fines levied on the Owner by governing authorities for SWPPP violations shall be back charged to the responsible party.

C. In the event of a chemical or hazardous spill or release, the individual(s) who caused the spill is responsible for prompt and proper clean-up. If the spill requires cleanup procedures beyond the means of the Contractor, an emergency spill cleanup Subcontractor shall be hired by the Contractor. They shall be utilized when the Contractor does not have the appropriate training, equipment or materials to cleanup the area safely and effectively. This shall be done at no additional cost to the Owner. Any testing and cleanup required post cleanup shall be provided by the Contractor at no additional cost to the Owner.

1.06 JOB CONDITIONS

A. Job conditions in Sections 311201, 312201, 329201 and 334001 apply.

B. Contractor will take all necessary precautions to avoid allowing dust generation that violates NYSDEC regulations and compromises compliance with governing authorities air monitoring plan.

C. Winter Stabilization Requirement: When construction schedule, regardless of reason, prohibits installation of permanent stabilization measures and site elements, including substantial lawn growth to prevent erosion, this Contractor shall install and provide temporary seeding, mulching, and other preventative/stabilization measures specified and as directed by the Landscape Architect at no additional cost to the Owner.

1.07 CERTIFICATIONS

A. Authorized, legally responsible signatures for the General Contractor, Site Contractor, Site Earthwork, Landscaping Subcontractor(s) and any other soil disturbing Contractor shall sign and prominently display the following certification statement at the job trailer or office during the life of the project:

"I hereby certify under penalty of law that I understand and agree to comply with the terms and conditions of the Storm Water Pollution Prevention Plan (SWPPP) and agree to implement any corrective actions identified by the qualified inspector during a site inspection. I also understand that the owner or operator must comply with the terms and conditions of the most current version of the New York State Pollutant Discharge Elimination System ("SPDES") general permit for storm water discharges from construction activities and that it is unlawful for any person to cause or contribute to a violation of water quality standards. Furthermore, I am aware that there are significant penalties for submitting false information, that I do not believe to be true, including the possibility of fine and imprisonment for knowing violations."

1. General Contractor

Signature: _____

Name: _____

Title: _____

Address: _____

_____

Phone No.: _____

Email: _____

2. Site Earthwork Contr.

Signature: _____

Name: _____

Title: _____

Address: _____

_____

Phone No.: _____

Email: _____

3. Site Landscaping Contr. Signature: _____

Name: _____

Title: _____

Address: _____

_____

Phone No.: _____

Email: _____

4. Other Sub Contractors as determined by the Architect Signature: _____

Name: _____

Title: _____

Address: _____

_____

Phone No.: _____

Email: _____

1.08 NOTICES

A. The Operator (Owner) shall file with the New York State Department of Environmental Conservation (NYSDEC) a Notice of Intent (NOI) a minimum of ten (10) days prior to start of construction. Unless notified by the NYSDEC to the contrary within ten (10) days, a general SPDES permit is automatically issued which authorizes discharge of storm water on the construction site.

B. When the site has been finally stabilized, the Operator (Owner) shall file with the NYSDEC a Notice of Termination (NOT).

C. The Operator (Owner) is responsible for payment of annual fees related to the SPDES permit. Filing of a NOT shall typically terminate the Operator's fee responsibility.

1.09 INSPECTIONS AND MAINTENANCE

A. The Architect or qualified personnel of the Operator shall inspect disturbed areas of the construction site at least once per week. Special attention will be focused on areas not finally stabilized, structural control measures, point discharge (outlets) and locations where vehicles enter or exit the site. Disturbed areas will be inspected for pollutants entering the drainage system. Structural control measures will be reviewed for

effectiveness in preventing significant impacts to receiving waters. Locations where vehicles enter or exit the site will be inspected for evidence of off-site sediment tracking. A written report of inspections shall be produced in a journal during the construction operations. The journal shall be made available (by the Operator/Owner) for NYSDEC and the general public to review.

B. The Contractor shall provide timely maintenance of vegetation erosion and sediment control measures, and other protective measures, during construction. Corrective measures must be performed within one (1) calendar day of the Architect's or Operator's (Owner's) report. Failure by the Contractor to perform corrective work within this schedule automatically authorizes the Operator to hire others and backcharge this Contractor. The Architect or Operator will send a letter or email correspondence one (1) calendar day before hiring others and backcharging this Contractor. The Contractor shall keep a written record of maintenance and corrective work in a journal. The journal shall be made available for the Operator, Architect, Landscape Architect, Soil and Water Conservation District, ACOE, and NYSDEC until the site is finally stabilized.

C. The Contractor shall conduct daily inspections of the equipment staging and maintenance, fueling, hazardous waste staging and waste storage areas to ensure that spill control measures are in place. Stock appropriate clean-up materials whenever changes occur in the types of chemicals used or stored on site.

D. The Contractor is responsible for having mandatory, up to date NYSDEC endorsed 4-hour erosion and sediment control (E&SC) training all personnel working on site in accordance with the SPDES permit.

E. The Operator (Owner) shall provide long-term maintenance of the storm water facilities after the site is finally stabilized. The designated maintenance personnel shall keep written records and pictures of maintenance and corrective work in a journal. All stormwater discharge points shall be maintained, inspected, and documented. The journal shall be made available for review by the NYSDEC for a minimum period of five (5) years after the Notice of Termination (NOT) has been filed.

1.10 SPILL PREVENTION, REPORTING AND DOCUMENTATION

A. To minimize the potential for discharge to the environment of oils, petroleum, or other hazardous substances, the following requirements shall apply:

1. All oil, petroleum, or hazardous materials stored or temporarily relocated on site during the construction process shall be stored in a way to provide protection from vehicular damage and to provide containment of leaks or spills. Temporary berms, dikes, storage basins, or similar methods shall be employed as appropriate on site.

2. Refer to Storm Water Pollution Prevention Plan Notes for additional spill prevention good housekeeping practices.

3. Maintain file of Material Safety Data Sheets (MSDSs) or other references for recommended spill clean-up methods and materials.

4. Keep spill response equipment readily accessible.

B. In the event of a spill contact the Construction Manager, Owner (Operator), and Architect. The Contractor shall also notify all other Contractors working around the area of the spill.

C. If spilled material has entered any sanitary/storm sewer system then contact the municipality or agency with jurisdiction over the system, in addition to those listed in this section.

D. The contractor shall be responsible for the initiation of spill reporting and documentation procedures. All petroleum spills must be reported to NYSDEC Spill Hotline at 1-800-457-7362, less than two (2) hours following discovery. All petroleum spills must be reported to NYSDEC unless all of the following apply:

Criteria	Description
Quantity	Must be known to be less than 5 gallons.
Containment	Must be contained on an impervious surface or within an impervious structure. No access to the environment.
Control	Must be under control and not reach a drain or leave the impervious surface.
Cleanup	Must be cleaned-up within two (2) hours of occurrence.
Environment	Must not have already entered into soil or groundwater or onto surface water.

E. A release of a "reportable quantity"[1] or unknown amount of a hazardous substance must also be immediately reported to the NYSDEC Spill Hotline. Spills of reportable quantities of chemicals or "harmful quantities"[2] of oil to navigable waters must be reported to the federal National Response Center, 1-800-424-8802 or 1-202-426-2675.

[1] *Reportable Quantity*: Refers to the quantity of a hazardous substance or oil that triggers reporting requirements under the Comprehensive Emergency Response, Compensation, and Liability Act (CERCLA) (USEPA, September 1992).

[2] *Harmful Quantity*: Includes discharges that violate applicable water quality standards, cause a film, sheen, or discoloration on a water surface or adjoining shoreline; or cause a sludge or emulsion to be deposited beneath the water surface or shoreline (40 CFR 110.3).

PART 2 - PRODUCTS

2.01 STORM STRUCTURE PROTECTION

A. Shall be commercially manufactured, needle-punched, non- woven geotextile, comprised of polypropylene fibers. Standard of quality shall be Mirafi 140N as manufactured by Tencate/Mirafi Group, www.tencate.com, or Architect approved equal.

OR

B. Fiber rolls/ Wattles, (refer to 2.09)

2.02 SILT FENCE

A. Shall be a woven polypropylene geotextile comprised of UV stabilized polypropylene slit film and 1.25" square, non pressure treated, pointed, hardwood posts and net mesh backing for additional support. Standard of quality for silt fence shall be IVI-3611MW as manufactured by Indian Valley Industries, Inc., www.iviindustries.com, (607) 729-5111, or Architect approved equal.

2.03 OFF SITE SEDIMENT TRACKING CONTROL

A. No. 3 stone shall meet the following requirements:

Standard ASTM Sieve Size	Percent Passing by Weight
3"	100
2"	0-15
Passing No. 50	5-10
Passing No. 100	2-5

B. Soil Stabilization Fabric: Shall be a commercially manufactured, UV stabilized low clogging, high flow, woven geotextile. Standard of quality shall be Mirafi 600X, as manufactured by NICOLON/MIRAFI GROUP, 3500 Parkway Lane, Norcross, Georgia (Tel. 1-800-234-0484) or Architect approved equal.

C. Granular Base Course Material (for Type 2 only): Shall be as specified in Section 312201.

2.04 TEMPORARY SEDIMENT FILTER BAG FOR PUMPED WATER

A. Provide prefabricated bags/pouches with nonwoven geotextile fabric. The standard of quality shall be Dirtbag as manufactured by ACF Environmental, 800-448-3636 or Architect approved equal.

B. Provide wooden pallet to set filter bag on for ease of disposal.

2.05 TEMPORARY CONCRETE WASHOUT FACILITY

A. Concrete washout facility to fully contain all concrete washout needs of the entire project and all contracts.

B. Concrete washout facility shall be temporary straw bales that are lined with a single sheet of a minimum of 10 mil polyethylene sheeting that extends over the entire basin to prevent escape of discharge. Place a secure, non-collapsing, non-water collecting cover over the concrete washout facility prior to inclement weather to prevent accumulation and overflow of precipitation.

C. Provide concrete washout to prevent discharge from concrete trucks or equipment cleaning to inlets, surface or groundwater.

D. Concrete washout facility shall be no closer than 50 feet from environmentally sensitive areas such as waterbodies, wetlands, and open drainage facilities and watercourses. Signs shall designate concrete washout facilities.

E. Ensure that the concrete washout facility complies with all Federal, State and local laws, rules, and regulations. Ensure that the concrete washout facility is in place before delivery of concrete to site.

F. Provide a sign identifying area as "Concrete Washout" acceptable to the Architect. Maintain throughout the project duration.

2.06 TEMPORARY SEEDING AND MULCHING

A. Seeding shall be 100% Perennial Ryegrass with no more than 30% of any one cultivar and always at least 2 different cultivars and a 90% germination rate or more.

B. All seed mixtures contain 0.5% weed seed or less.

C. All seed must be fresh seed, not seed that is left over from last year and beyond the sell by date.

D. Dry mulch shall be clean straw bales.

2.07 PERMANENT SEEDING

Seeding shall be as specified in Section 329201.

2.08 STRAW MAT

A. 100% biodegradable thread on 1.5-inch centers stitched to a 100% biodegradable natural fiber top net. Blanket shall be manufactured with a colored line or thread stitched 2-5 inches from edge to ensure proper overlap. Standard width is 4'-0".

B. Standard of quality shall be BioNet Blanket as manufactured by North American Green, 1-800-772-2040 or Architect approved equal for the following slope conditions:

Slope Condition	Water Flow Condition	Product Type
4:1 (or flatter)	Low flow (5 fps)	S75BN: Single Net Straw
3:1	Moderate flow (6 fps)	S150BN: Double Net Straw
2:1	Medium flow (8 fps)	SC150BN: Double Net Straw-Coconut (70/30 blend)
1:1 (and greater)	High Flow (10 fps)	C125BN: Double Net Coconut

C. Stakes: Six-inch lengths of 100% biodegradable "T" shaped pin designed to safely secure erosion control blanket. Standard of quality shall be Bio-Stake as manufactured by North American Green or Architect approved equal.

2.09 FIBER ROLL (STRAW WATTLE)

A. Shall be a pre-manufactured cylindrical log of coconut fibers encased in a netting of biodegradable jute, nylon or burlap. Rolls shall be between 8"-10" in diameter, 25' in length and shall weigh at least 1.8 pounds per linear foot. The netting shall be secured tightly at each end of the rolls.

B. Wood stakes shall be a minimum of 2" x 2" x 24" in size. Shall be untreated fir, redwood, cedar or pine and shall be cut from sound timbers. Shall be straight and free of loose and unsound knots or other defects which would render them as unfit for the intended use. Metal stakes may not be used as an alternate. Tops of stakes shall not extend above the top of the fiber roll.

C. Rope shall be biodegradable with a minimum diameter of ¼ inch.

D. Standard of quality shall be Photodegradable Fiber Rolls as manufactured by American Fiber Rolls (866) 446-2594 or Architect approved equal.

2.10 SPILL RESPONSE EQUIPMENT

A. The following is a list of recommended spill control material. The contractor is responsible to have spill control and personnel protective equipment readily available for the materials being used. Acquire sufficient quantities and types of appropriate spill control materials needed to

contain any spills that can be reasonably anticipated. The need for equipment to disperse, collect and contain spill control materials should be on site at all times.

1. Personal Protective Equipment
   a. Chemical Splash Goggles
   b. Gloves
   c. Boot Covers
   d. Tyvek Aprons or Suits

2. Absorption Materials
   a. Spill Pillows and Socks
   b. Absorbent Booms and Pads
   c. Dikes for use on rough surfaces
   d. Storm Structure Covers
   e. “Loose” Absorbents

3. Tools
   a. Shovel, Broom, Brush
   b. Disposal Bags
   c. Sealing Tape
   d. Hazardous Waste Stickers
   e. “Danger” and “Keep Away” Signs
   f. Five-gallon pails or 20-gallon drums with polyethylene liners

B. Basis of Design shall be provided by 3M, 888-364-3577; New Pig Corporation, 800-468-4647; SpillKits911, 800-474-5911; Dawg, Inc., 800-935-3294; or Architect approved equal.

C. Place spill response equipment in a readily assessable location within or immediately adjacent to the project site.

PART 3 - EXECUTION

3.01 SIGNATURE REQUIREMENTS

A. Between the Pre-Construction Meeting and starting site work, the Contractor shall:

1. Sign the certification statements. The Contractor shall prominently display the statements at the job site.

2. Review inspection and maintenance procedures. Decide where journals will be temporarily stored for review by NYSDEC, S&WC, ACOE, Operator (Owner), the Landscape Architect and Architect.

3. Designate specific Owner and Contractor personnel responsible for daily inspection and maintenance. Provide certification cards.

3.02 GENERAL EROSION CONTROL

A. Install initial construction erosion control features, as indicated on drawings and specifications or as directed by the Architect, prior to earthwork, and removal of existing pavements or vegetation. Keep the disturbance to a minimum and shall not exceed five (5) acres, unless directed by the Architect. Install other features as described in the sequence of erosion, sediment and pollution control on the drawings.

B. Start permanent seeding and mulching within seven (7) calendar days of rough grading. When this is not possible for any reason, provide temporary seeding on non-roof, non-

paved areas with 100% perennial rye grass at the rate of six pounds (6#) seed per one thousand (1,000 sf) square feet and straw mulching for complete coverage. When adverse weather conditions prevent good germination, repeat seeding and mulching as directed by the Architect until the area is stabilized. Till under temporary grass and fine grade when preparing for final permanent lawn stabilization.

C. Until a disturbed area is stabilized, trap runoff sediment by the use of sediment debris basins, diversion swales, sediment traps, or other methods acceptable to the Architect and governing authorities. Provide temporary dry mulch (straw) to stabilize exposed soils as directed by the Architect.

D. Provide erosion controls on slopes and swales traversing, bordering, or leaving the site. Limit the water flow to a nonerosive velocity.

E. Do not store fill materials within one hundred (100') feet of the banks of any streams or waterbodies, intermittent or perennial.

F. Inspect erosion and sediment control measures immediately after each rainfall and at least daily during prolonged rainfall. Make required repairs immediately.

G. Remove sediment deposits when they reach approximately one-half of the height of the barrier. Dispose sediment in a manner that does not result in additional erosion or pollution.

H. Provide prompt (weekly) removal and disposal of rubbish and debris in accordance with the governing authorities, Owner policies, and good housekeeping measures.

3.03 MUNICIPAL SEWER, PUBLIC RIGHT of WAY & BODIES of WATER EROSION CONTROL

Control erosion, siltation and pollution to municipal sewers, public right of ways, bodies of water by taking appropriate measures such as, but not limited to, the following:

A. Do not disturb the bed and banks of waterbodies unless specifically shown on drawings. When bed and bank work is shown, obtain permits and proceed with work creating the minimum disturbance necessary to complete the project.

B. Prevent petroleum products and excessive amounts of silt, clay, and muck from entering municipal sewers, waters, swales or wetlands of New York State during construction.

C. Prevent fresh concrete, concrete leachate, and washings from equipment and trucks, from entering municipal sewers, waters, swales or wetlands of New York State during construction.

D. Place silt fence to control erosion at the downslope edge of disturbed areas. This barrier to sediments is to be put in place before disturbance of the ground occurs and is to be maintained in good condition until disturbed land is heavily vegetated or otherwise permanently stabilized.

E. Seed areas of soil disturbance resulting from this project with appropriate perennial grass seed and mulched with straw within seven (7) calendar days as described in general erosion control. Mulch shall be maintained until a suitable vegetative ground cover is established and as directed by the Architect.

3.04 CONSTRUCTION SITE DUST CONTROL

A. The Contractor shall prevent surface and air movement of dust from disturbed soil surfaces that may cause off-site damage, health hazards, and traffic safety issues.

B. Dust control applies to construction roads, access points, other disturbed areas and stockpiles subject to surface dust movement and dust blowing.

C. Contractor may use any number and combination of dust control methods, as approved by the Architect. They include:

1. Applying water to haul roads
2. Restricting vehicle speeds to 10 mph
3. Hauling materials in properly tarped or watertight containers.
4. Covering stockpiles and materials
5. Wetting equipment and work area
6. Mulching
7. Spray adhesives and polymer additives (MSDS sheets required)
8. Barriers and wind breaks

D. Contractor is responsible for any cleanup and site restoration associated with dust control measures, dust pollution on or off the project site property at no additional cost to the Owner.

3.05 STORM STRUCTURE PROTECTION (IN LAWN AREAS)

A. Cut fabric from a continuous roll to eliminate joints. If joints are needed, they will be overlapped to the next stake.

B. Space stakes evenly around inlet 3 feet apart and drive a minimum 18 inches deep. Spans greater than 3 feet may be bridged with the use of wire mesh behind the filter fabric for support.

C. Fabric shall be embedded 1 foot minimum below ground and backfilled. It shall be securely fastened to the stakes and frame.

D. A 2" x 4" wood frame shall be completed around the crest of the fabric for over flow stability.

.3.06 STORM STRUCTURE PROTECTION (IN DISTURBED PAVED AREAS)

A. Install fiber rolls, (wattles) around storm inlets and secure in place with sandbags or stakes.

B. Wrapping the storm inlet grate with filter fabric is acceptable when other means are not feasible.

3.07 SILT FENCE

A. Locate as shown on drawings and as directed by the Architect. Excavate trench along the lower perimeter(s) of site, along the contract limit line, and as indicated on the drawings. Place excavated material on uphill side of trench for backfilling.

B. Drive stakes securely into the downhill side of the trench. When prefabricated silt fence with fabric attached to stakes is used, drive stakes so that fabric is buried in the ground as detailed.

C. Backfill trench with excavated material, so that fabric is securely buried in the ground to prevent undermining. Tamp soil.

D. Join sections by overlapping fabric between two (2) stakes. Set stakes simultaneously. Overlap by minimum six (6") inches, fold, and staple to prevent sediment bypass.

E. Attach silt fence securely to stakes spaced no more than eight (8' o.c.) feet on center. Secure fence fabric to stake with minimum three one (1") inch staples.

F. Toward the end of the project, when site is stabilized and as directed by the Architect, remove silt fence and correct lawn area around removal to a smooth, neat, well-draining condition.

3.08 OFFSITE SEDIMENT TRACKING CONTROLS

A. Install as detailed and shown on drawings to eliminate tracking sediment off site. Inspect after each rain storm and at the end of each work day.

B. When sediment begins tracking off site, sweep and clean affected roadway immediately and replace stone with clean No. 3 stone to retain sediment on site.

C. Remove fabric and stone at project completion. Complete construction of proposed final surface(s).

3.09 TEMPORARY CONCRETE WASHOUT FACILITY

A. Install per detail in a location as approved by the Owner. Provide a stable surface, easily accessible by concrete trucks.

B. A sign shall be installed adjacent to each washout facility to inform concrete equipment operations to utilize the proper facilities. The sign shall be installed as detailed and maintained throughout the project.

C. Temporary concrete washout facility shall be constructed and maintained in sufficient quantity and size to contain all liquids and concrete waste generated by washout operations for the entire project and by all Contracts.

D. Perform washout of concrete mixers, delivery trucks, and other delivery systems in designated areas only.

E. Wash concrete only from mixer chutes into approved concrete washout facility.

F. Plastic lining material shall be a minimum of 10-mil polyethylene sheeting and shall be free of holes, tears or other defects that compromise the impermeability of the material. Liner seams shall be installed in accordance with manufacturers' recommendations.

G. Contents of the concrete washout facility shall not exceed 50% capacity of the facility. At or before 50% capacity is reached, discontinue pouring concrete until the facility is cleaned out. Remove hardened concrete and properly dispose off site. Allow slurry to evaporate or remove from site and dispose off site. Immediately replace the liner if it gets damaged.

H. Remove concrete washout facility when it is no longer needed as directed by the Architect.

3.10 TEMPORARY SEEDING AND MULCHING

A. Provide temporary seeding of topsoil stockpile immediately.

B. When necessary and as directed by the Architect, provide temporary seeding and mulching on disturbed areas at no additional cost to the Owner.

3.11 PERMANENT SEEDING

A. Install as described in Section 329201.

3.12 STRAW MAT

A. Install as recommended by the manufacturer and as directed by the Architect for drainage channels and slopes.

B. Stake spacing shall reflect slope to which the straw is being applied.

3.13 FIBER ROLL /WATTLES

A. Install fiber roll (wattles) around storm inlets and secure in place with sandbags or stakes.

B. When silt fence barriers are not practical, install fiber rolls along un-stabilized slopes, around storm inlets or pavement edges. Maintain until site stabilization is achieved.

3.14 SPILL RESPONSE EQUIPMENT

Use per manufacturer's recommendations and as directed by the NYSDEC, or other governing agencies.

3.15 CLEAN UP

A. During the contract and at intervals as directed by the Architect and as erosion, sediment and pollution control procedures are completed, clear the site of extraneous materials, rubbish, and debris. Leave the site in a clean, safe, well draining, and neat condition.

B. Clean catch basins or storm inlets: Clean out contaminants, sediment, rubbish, construction debris, foreign objects and accumulated floatables from chambers and ponding areas thoroughly, immediately prior to final acceptance.

END OF SECTION 31 25 01

SECTION 31 66 13

AGGREGATE PIERS

PART 1 – GENERAL

1.01 – INTRODUCTION

A. The Aggregate Pier Specialty (APS) **Subc**ontractor shall design a ground improvement system consisting of Aggregate Piers (APs) and Load Transfer Platforms (LTPs) to support all footing foundations and slabs-on-grades shown on the Project Foundation Plan (Foundation Plan – Overall on Structural Drawing, Sheet S-100).

B. The APS **Subc**ontractor will be allowed to enter the site after their Contract is executed by the owner and at an agreed upon time with the owner and construction manager. Existing building and utility demolition will occur prior to the APS **Subc**ontractor mobilizing to the site. The site will be cut and/or filled to working pad elevation, which is approximately 18-inches (i.e., 18 ± 3 inches) below plan finish first floor elevation. The APS **Subc**ontractor shall familiarize themselves with current site conditions.

C. The APS **Subc**ontractor shall construct the Aggregate Piers, such that when they leave the site, the top of the Aggregate Piers will be at the bottom of the Load Transfer Platform.

D. The Construction Manager shall provide horizontal and vertical survey control points on-site for the APS **Subc**ontractor's use. Layout of Aggregate Piers shall be by the APS **Subc**ontractor's Licensed Land Surveyor.

E. CME Associates, Inc. has prepared a Subsurface Exploration and Foundation Recommendations Report, labeled Report No. 28107B-01-0224, dated 02/23/2024, and Subsurface Exploration and Foundation Recommendations Report – Addendum 1, labeled Report No. 28107B-02-0824, dated 08/05/2024, which can be provided upon request.

1.02 – SUMMARY

A. Design of the Aggregate Pier System for this project is delegated to the APS **Subc**ontractor. The APS **Subc**ontractor shall install the work such that it achieves the performance requirements outlined in Section 1.04. This includes, but is not limited to, providing all materials, equipment, labor, design, engineering, record keeping, survey control, quality control, management, and on-site superintendence.

B. The APS **Subc**ontractor will be required to submit a work plan that is subject to review and approval by the Structural Engineer.

C. The Owner's Inspection Agency will independently observe the APS **Subc**ontractor's work procedures and modulus test (load test). The Owner's Inspection Agency will report all observations to verify the APS **Subc**ontractor's compliance with the Approved Aggregate Pier Submittal. These reports will be forwarded to the Architect, Owner, Geotechnical Engineer, and Construction Manager, for review and final acceptance of the work installed.

1.03 – DEFINITIONS

A. **Aggregate Piers** are columns of compacted aggregate used to reinforce the ground to increase bearing capacity and reduce settlement of a structure. Aggregate Piers are constructed with a down-hole vibrator.

B. **Down-Hole Vibrators** are specially designed, high-energy vibrators. The horizontal vibrations are created by a motor and eccentric weight located near the tip of the vibrator. Extension tubes are bolted to the vibrator to allow it to be lowered to the necessary treatment depth.

C. **Bottom Feed Vibrators** are down-hole vibrators which are equipped with a tremie pipe through which the aggregate is fed to the top of the vibrator. This equipment is most often used in soil conditions which are too soft or cohesionless to remain open when pre-drilled.

D. **Load Transfer Platform** is a layer consisting of compacted Granular Fill with or without reinforcement (geotextile fabric, geogrid, etc.) installed between the bottom of concrete foundation elements and top of Aggregate Piers, to satisfactorily transfer and/or distribute foundation loads to Aggregate Piers and surrounding soils.

1.04 – PERFORMANCE REQUIREMENTS

A. Design, furnish, install, and monitor Aggregate Pier and Load Transfer Platform installation to ensure that the Head Building and Shed Building areas will provide reliable support for conventional shallow foundations designed for a 4,000 psf soil bearing pressure and slabs-on-grade designed for a Modulus of Subgrade Reaction of 200 pci. Foundation settlement shall be limited to 1-inch total and ¾-inches of differential between adjacent isolated spread footings. Also, the Aggregate Pier installation shall improve the slab-on-grade subgrade soil to allow for the construction of a slab-on-grade designed using a maximum slab live load noted on the structural drawings over all areas, plus the dead load of the slab. For all slab-on-grade areas, the settlement tolerance of ½-inch (total) and ¼-inch over 10-feet (differential) shall be met. The design life of the foundation system shall be 100 years. Please note, the APS **Subc**ontractor shall review the existing site grades and compare them to finish grades in structural areas. Any loads due to new weight of fill shall be accounted for in their design, which shall include down drag loads, if any, on the Aggregate Piers.

   1. Delegated Design: Design of the Ground Improvement System (APs and LTPs) shall be provided by a qualified Professional Engineer licensed in New York State, using the performance requirements and design criteria outlined herein. Please reference the New York State Education Department Website, Office of the Professions, Practice Guidelines Section 29.3 (b) (2), for details on Delegated Design.
   2. Perform Aggregate Pier installation without damaging existing buildings, utilities, and structures.
   3. Conduct pre-drilling of holes as necessary, and stockpile spoils in a designated area to be removed by others.
   4. Construct the Aggregate Piers to the lines and grades shown in the Contract Documents.

B. The designer of the soil improvement system shall submit a letter sealed by a qualified Professional Engineer registered in the State of New York, that confirms the following:

   1. The ground improvement system will result in improved soils to support conventional footing foundations (not pile caps), using an allowable soil bearing pressure of 4,000 psf (with a minimum

factor of safety of 2.0), while limiting total foundation settlement to 1-inch and differential foundation settlement to ¾-inch between adjacent isolated spread footings, under service loads.

The ground improvement system will result in improved soils to support the slab-on-grade loading discussed in Section 1.04 A, while limiting total slab settlement to ½-inch and differential slab settlement to ¼-inch over a 10-foot span.

C. Insurance: Refer to Trade Contract Requirements.

1.05 – SUBMITTALS

A. The following shall be submitted to the Construction Manager by the APS **Subc**ontractor with their bid:
   1. A list of at least five previously completed projects of similar scope for approval by the Owner. The list shall include a description of each project, relative size, and contact person with phone number and e-mail address.

B. The following shall be submitted to the Construction Manager by the APS **Subc**ontractor not less than three weeks prior to the start of the work:

   1. Resumes of the Project Manager, On-site Superintendent, and Design Engineer.

   2. The Aggregate Pier Delegated Design is based on information contained in the Contract Documents, prepared by a Registered Professional Engineer licensed in the State of New York that demonstrates that the program will achieve the specified Performance Requirements of Section 1.04. All calculations and analyses shall be logically formatted and presented in a Design Report which shall be signed and sealed in accordance with NYS Education Law. This submittal will be reviewed by the design team for overall conformance with the requirements of this spec section, and returned to the APS **Subc**ontractor, prior to the start of the field work, and prior to the Aggregate Pier pre-installation conference.

   3. Working Drawings with Notes and Specifications, indicating the spacing, location, and depth of the Aggregate Piers to achieve the performance criteria outlined herein. Each pier shall be uniquely numbered on the Working Drawings for reference.

   4. Work Plan outlining all procedures, quality testing and quality control criteria. Detail the minimum horizontal distance between the edge of new Aggregate Piers and top of future excavation, such that the structural integrity of the pier is not affected.

   5. Soil Modulus Testing procedure includes setup, recordation, report forms, and required nominal results.

   6. Aggregate Pier equipment specifications.

   7. Proposed aggregate product test results, source, gradation and soundness.

C. The following shall be submitted to the Construction Manager by the APS **Subc**ontractor during the work and not less than 2 business days following each work shift:

1. Accurate daily records that include the type and size of compaction equipment and predrill auger diameter used, and, for each Aggregate Pier, the identification number and depth of the pier tip.

2. Any change in the subsurface conditions or reaction of the vibrator or operation observed during the work.

3. The Soil Modulus Test report for two tests, including analysis of the data, and a statement that the Performance Requirements have been met.

D. The following shall be submitted to the Construction Manager by the APS **Subc**ontractor within 3 weeks of completion of the work:

1. A Final Report outlining a summary of the Aggregate Pier Installation and results of the Soil Modulus Testing. This report will certify that the required bearing pressures have been achieved and settlement tolerances will be met. This report shall be signed and sealed by the APS **Subc**ontractor's Registered Professional Engineer responsible for the Design, in accordance with New York State Education Law.

1.06 – PRE-INSTALATION CONFERENCE

A. Pre-installation Conference: A pre-installation conference will be held at the project site at least three days prior to the APS **Subc**ontractor mobilizing to the site, and after the APS design submittal review by the Design Team. Attendees shall include the APS **Subc**ontractor's Project Manager and On-site Superintendent, Earthwork Contractor, Structural Engineer, Geotechnical Engineer, Architect, Owner's Inspection Agency, and the Construction Manager. No Aggregate Pier work shall occur prior to this conference being held.

1. Review methods and procedures related to the Aggregate Pier operation, including, but not limited to the following:

a. Geotechnical reports prepared by CME Associates, Inc., as well as applicable Contract Drawings and this Spec Section.
b. APS **Subc**ontractor's Approved Submittal.
c. Working area location, staging of equipment, progression of work, spoils area designation, encounter of obstructions, work hours, and other details of the daily work.
d. Layout and field engineering.
e. Existing utilities and subsurface conditions.
f. Proposed improvement area.
g. Monitoring of Aggregate Pier operation.
h. Owner's Inspection Agency duties and responsibilities.
i. Final Report by APS **Subc**ontactor.
j. Chain of command for communication.
k. Job site safety

1.07 – PROJECT CONDITIONS

A. Interruption of Existing Utilities: The Aggregate Pier contractor shall not interrupt any utility serving facilities occupied by Owner at this site unless permitted under the following conditions, and then only after arranging to provide temporary utility according to the requirements indicated:

1. Notify Architect no fewer than two days in advance of proposed interruption of utility.
2. Do not proceed with interruption of utility without written permission.

B. Protection of Existing Utilities: Do not damage any utility with Aggregate Pier operations.

C. Project Site Information: A subsurface geotechnical evaluation has been prepared for this project by CME Associates, Inc., and their reports are available for informational purposes only. The opinions expressed in said reports are those of the Geotechnical Engineer and represent interpretations of subsurface conditions, tests, and results of analyses conducted by the Geotechnical Engineer. The Owner or Geotechnical Engineer will not be responsible for interpretations or conclusions drawn from the data, by others.

1. The APS **Subc**ontractor shall make additional test borings or excavations as deemed necessary by the APS **Subc**ontractor and conduct other exploration operations as necessary to design and install the ground improvement system.

1.08 – RELATED SECTIONS

A. Structural Tests and Special Inspections
B. Soils for Earthwork
C. Aggregates for Earthwork
D. Site Clearing
E. Rough Grading
F. Excavation

PART 2 – EQUIPMENT AND MATERIALS

2.01 – EQUIPMENT

Down-Hole Vibrator: The down-hole vibrator shall be capable of providing at least 80 HP of rated energy and a centrifugal force of 15 tons. An appropriate metering device shall be provided at such a location that inspection of amperage increase may be verified during the operation of the equipment. The metering device may be an Ammeter directly indicating the performance of the vibrator tip.

2.02 –MATERIAL

The Aggregate Pier material shall consist of hard, angular to sub-angular durable rock fragments, meeting the quality and gradation requirements of ASTM C33 No.57 Coarse Aggregate Stone.

PART 3 – EXECUTION

3.01 – SITE INSPECTION AND VIBRATION MONITORING

A. If an adjacent building is located within 50 feet of the Aggregate Pier work area, vibration monitoring shall occur. Vibration monitoring will be performed on the first day of Aggregate Pier operations at one location specified by the Architect. Monitoring may be required on subsequent days as ordered by the Architect. The cost of this Item (day one) shall be included in the APS **Subc**ontractor's base bid. Subsequent monitoring, if required, will be paid on a per day basis. Allowable Peak Particle Velocity (PPV) is 2 inches/second. The Contractor shall inform the Architect immediately when measured particle velocity is greater than 85% of PPV (1.7 inches/second). If the measured velocity exceeds the allowable PPV, the APS **Subc**ontractor shall cease operations and revise the Aggregate Pier operations to reduce vibrations to allowable levels.

3.02 –AGGREGATE PIER CONSTRUCTION

The general procedures are as follows:

A. **Stable Ground Conditions:** The following general procedures shall be followed when the pre-drilled hole remains open during construction.

1. Pre-drilling to the design depth will be performed with an auger diameter equal to the finished aggregate pier diameter.

2. The quantity of aggregate initially added shall be such that the vibrator tip is able to penetrate to within 12 inches of the design depth. The vibrator will be raised and lowered repeatedly, such that on each re-penetration, the tip of the vibrator advances to within 12 inches of the previous penetration depth.

3. The aggregate shall be removed and replaced with fresh aggregate if cave-ins occur during the aggregate placement such that the volume of caved-in soil is greater than 10 percent of the aggregate being compacted.

B. **Unstable Ground Conditions:** The following general procedures will be followed when a pre-drilled hole will not remain open before or during pier construction.

If the hole remains temporarily stable, the hole may be filled with aggregate to a level above instability if the vibrator is still able to penetrate to within 1 foot of the pre-drilled depth. If the hole will not remain temporarily stable, a Bottom Feed Down-Hole vibrator may be used.

C. **Obstructions:** Aggregate Piers shall be constructed within 6 inches of the design location. Obstructions encountered during excavation or drilling that prevent installation of the Aggregate Piers to design depth or cause the Aggregate Pier to stray from its specified location during installation shall be removed. The APS **Subc**ontractor shall be compensated for the obstruction time that is documented by the Owner's Inspection Agency.

Obstructions include, but are not limited to; boulders, timbers, concrete, and utility lines, that prevent installing the Aggregate Piers to the required depth or cause the Aggregate Pier to drift from the required location. Natural Bedrock shall not be deemed an obstruction, and piers may be terminated short of design lengths in Bedrock. The Aggregate Pier Design Engineer shall approve or reject any short piers within one work shift of installation.

3.03 – PERFORMANCE CRITERIA

A. Aggregate Piers shall be constructed to a depth sufficient to satisfy the Performance Requirements of Section 1.04. Two Soil Modulus Tests shall be performed to verify the parameter values selected for the Aggregate Piers, at locations approved by the Project Geotechnical Engineer and Architect. This testing will occur at the top of Aggregate Pier Elevation.

3.04 – FIELD QUALITY ASSURANCE

A. Inspection

1. All Aggregate Pier operations shall be performed in the presence of the Owner's Inspection Agency Representative.

2. Monitoring and logging of Aggregate Pier operations for both test and production piers shall be performed by the Owner's Special Inspector. At a minimum, the report for each pier shall include:

   a. Pier Identification
   b. Plan Top Elevation
   c. Date of Excavation (Drilling)
   d. Actual Ground Elevation
   e. Design Pier Length
   f. Design Pier Diameter
   g. As-Installed Depth of Pier Excavation
   h. As-Installed Pier Bottom Elevation
   i. As-Installed Pier Length
   j. Soil Type(s) Encountered during Pier Excavation
   k. Material at Pier Excavation Bottom
   l. Date of Aggregate Placement
   m. Type/Description of Aggregate
   n. Number of Aggregate Lifts Placed
   o. Average Aggregate Lift Thickness
   p. Actual Tamp Time
   q. Rammer Blow Deflections
   r. Rammer Energy Output
   s. Length of Casing Installed (if any)

3. The top of the Aggregate Pier shall be compacted and firm prior to the Soil Modulus Test.

B. Soil Modulus Test

Testing to determine specification compliance will be provided by the APS **Subc**ontractor and will consist of two Soil Modulus Tests at locations approved by the Design Team. The Soil Modulus Testing will take place on top of the Aggregate Pier, prior to the LTP being constructed. The Aggregate Piers used for the Modulus Testing may be used as production piers if they meet the design criteria and are approved by the Design Team.

1. Deflections of the top of the test pier shall be measured by a suitable and approved method.

2. Deflections at the bottom of the test pier shall be measured by means of a telltale installed at the bottom of the test Aggregate Pier. Performance will be deemed acceptable when, at the specified design stress, deflection at the bottom of the pier does not exceed 20% of the deflection at the top of the pier.

3. Load increments, decrements, and duration shall be determined using ASTM D-1143, as general guidelines. Further, test set-up shall occur such that the testing equipment is situated outside the zone of influence of the Aggregate Piers, as outlined in ASTM D-1143.

4. Surficial disturbance shall be compensated for by applying a seating load equal to 10% of the total load to the loading steel plate before applying load increments.

5. The Soil Modulus Test shall be performed as described in the Approved Design Submittal.

6. The Soil Modulus Test report shall be signed and sealed by the Aggregate Pier Design Engineer.

3.05 – FIELD QUALITY CONTROL

A. The APS **Subc**ontractor shall provide an experienced on-site quality control representative during the entire Aggregate Pier Operation to ensure that the Aggregate Pier Operation is executed in accordance with their submittal documents.

3.06 – REJECTION OF AGGREGATE PIERS

A. If an Aggregate Pier is installed at an incorrect location or does not meet the design requirements, the APS **Subc**ontractor shall replace the pier at their cost. Pier replacement may be avoided if alternate remedial procedures are approved by the Design Team.

3.07 – EXCAVATION WITHIN ZONE OF INFLUENCE OF AGGREGATE PIERS

A. Excavations made by the Earthwork Contractor after Aggregate Pier installation shall be performed such that the horizontal distance between the edge of any Aggregate Pier and the nearest edge of the excavation is such that the pier is not affected. If any excavation encroaches into an installed Aggregate Pier's zone of influence, defined in the APS **Subc**ontractor's submittal, the Earthwork Contractor and Architect shall collaborate to develop solutions for excavation or construction methods that will avoid detrimental impact to the installed Aggregate Piers. This situation shall be taken on a case-by-case basis and will depend on the subsurface conditions, site geometry, excavation geometry and weather, among other factors. If the integrity of any Aggregate Pier is in question, the APS **Subc**ontractor shall prepare a remedial plan to restore the pier to original condition. This plan shall be submitted to the Design Team for approval.

1. The remediation shall be observed and documented on-site by the Owner's Special Inspection Agency. Said agency shall also conduct density testing on-site, if backfill is utilized, and submit results of the density testing to the Design Team.

3.08 – BOTTOMS OF FOOTINGS AND SLAB-ON-GRADE SECTION

A. Excavation shall be made to plan bottom of Load Transfer Platform in proposed footing areas and to plan bottom of Subbase Course (or Load Transfer Platform, if required) in slab-on-grade areas in the presence of the Owner's Inspection Agency. Following excavation and approval of exposed grade, installation of Load Transfer Platform and Subbase Course may commence.

1. Footing bearing grade and subgrade for slab-on-grade shall be prepared as follows: Install Load Transfer Platform or Subbase Course over grade examined and approved by the Owner's Inspection Agency. All material placement and quality control testing shall conform to the requirements of the Contract Documents and Approved Aggregate Pier Submittal, which shall include satisfactory in-place density testing. One satisfactory density test shall be obtained at each spread footing location, one satisfactory density test shall be obtained for every 50 lineal feet of continuous footing and one satisfactory density test shall be obtained for every 2500 square feet of slab area.

2. Bearing grades shall be compacted if any loose soils are present.

3. Footing and slab-on-grade construction shall occur immediately following approval of the bearing grade (top of Load Transfer Platform and/or Subbase Course)

4. If concrete cannot be placed on the same day that bearing grade is approved, the contractor shall protect and maintain bearing grade until completion of foundation element installation.

B. The following criteria shall apply, and shall be verified by the Owner's Inspection Agency in a written report:

1. The footing excavation has been kept free of water since completion of excavation work such that the unconfined matrix soil surrounding the Aggregate Piers has not been softened, which may negatively impact the load bearing capability of the element.

2. The following specified procedures prior to construction of the footings have been followed:

   a. Inspection of bearing grade (top of LTP and/or Subbase Course) just prior to concrete placement, to ensure that it is firm and free of loose soil, mud, ice and water.

   b. Re-compaction, as required, of LTP and/or Subbase Course by mechanical impact compaction equipment.

3. Assurance that no excavation has been made within a distance that will affect any completed Aggregate Pier, without being approved in writing by the APS **Subc**ontractor and Architect.

3.09 – RESTRICTIONS

A. Aggregate Pier construction is performed under the Building Permit.

B. The General Contractor will be responsible for the field layout and delineation of existing above and below ground active utilities.

PART 4 – PAYMENT

4.01 – METHOD OF PAYMENT

A. Mobilization and demobilization shall be a Lump Sum Item included in the Base Bid.

B. Design and construction of the Aggregate Piers shall be a Lump Sum Item included in the Base Bid.

C. Soil Modulus Testing of 2 piers to be priced as a Lump Sum included in the Base Bid. An Add Unit Price Per Test shall be provided.

D. Additional Aggregate Piers constructed during the same mobilization shall be installed on a per linear foot basis, using unit pricing provided in the Aggregate Pier Contractor's Base Bid, and as authorized by the Owner.

E. Obstruction time documented by the Owner's Inspection Agency shall be paid on a Per Hour Basis as presented in the contractor's bid documents.

F. Vibration monitoring (equipment and technician) on a Per Day Basis after day 1.

G. Include 10-hours of APS **Subc**ontractor's Licensed Engineer to work with the Team on any issues outlined in this Specification Section, Section 3.07 as part of the base bid.

PART 5 – MISCELLANEOUS

5.01 – STRUCTURAL LOAD DATA

A. Refer to Stamped Structural Drawings for foundation and slab design loading for the Head Building and Shed Building foundations and slabs to be supported on the ground improvement system. These documents will be provided upon request.

END OF SECTION

SECTION 32 12 01
ASPHALT PAVING

PART 1 - GENERAL

1.01 DESCRIPTION OF WORK

A. The extent of asphalt paving is shown on the drawings.

B. Asphalt Paving work includes, but is not limited to, the following:

1. Soil Stabilization Fabric
2. Granular Base Course
3. Asphaltic Concrete
4. Bituminous Tack Coat
5. Painted Lines and Traffic Markings
6. Hot Pour Crack Sealing and Filling
7. Asphalt Pavement Sealing
7. Field Quality Control
8. Asphalt Price Adjustment
9. Clean up

C. Provide all materials, labor, equipment and services required to accomplish related work in accordance with the drawings and specifications.

1.02 RELATED WORK SPECIFIED ELSEWHERE

A. Section 311201 - Site Preparation

B. Section 312201 - Site Earthwork

1.03 REFERENCES

A. The latest editions of the following Standards, as referenced herein, shall be applicable:

1. New York State Department of Transportation Standard Specifications, Section 402 - “Hot Mix Asphalt (HMA) Pavements" and 407 - "Bituminous Tack Coat"
2. “Standard Specifications for Highway Materials and Methods of Sampling and Testing, American Association of State Highway and Transportation Officials (AASHTO).”
3. American Sports Builders Association (ASBA) Asphalt Guidelines, latest edition

B. The following reference standards shall apply for Testing and Inspection:

1. ASTM D1074: Standard Test Method for Compressive Strength of Bituminous Mixtures
2. ASTM D1188: Standard Test Method for Bulk Specific Gravity and Density of Compacted Mixtures Using Paraffin-Coated Specimens.
3. ASTM D2041: Test Method for Theoretical Maximum Specific Gravity and Density of Bituminous Paving Mixtures
4. ASTM D2726: Standard Test Method for Bulk Specific Gravity and Density of Non-absorptive Compacted Bituminous Mixtures
5. ASTM D2950: Standard Test Method for Density of Bituminous Concrete in Place by Nuclear Methods
6. ASTM D3203: Standard Test Method for Percent Air Voids in Compacted Dense and Open Bituminous Paving Mixtures

7. ASTM D3549: Standard Test Methods for Thickness or Height of Compacted Bituminous Paving Mixture Specimens
8. NYSDOT Materials Method 28 Friction Aggregate Control and Test Procedures

C. The following reference standards shall apply for pavement markings:

1. ASTM D562, D711, D1475, D1640, D2369, D3723, D3960.
2. DOT Code of Federal Regulations, Hazardous Materials and Regulations Board, Reference 49CFR, ICC Regulations
3. Federal Specification TT-P-115E, Type III (Type I if V.O.C. compliance)

D. Additional testing required, only if directed in writing by Architect, due to asphalt installation and material issues:

1. ASTM C295: Standard Guide for Petrographic Examination of Aggregate
2. ASTM D1560: Standard Test Methods for Resistance to Deformation and Cohesion of Bituminous Mixtures by Means of Hveem Apparatus
3. ASTM D4125: Standard Test Methods for Asphalt Content of Bituminous Mixtures by the Nuclear Method
4. ASTM D5444: Standard Test Method for Mechanical Size Analysis of Extracted Aggregate
5. ASTM D6307: Standard Test Method for Asphalt Content of Hot-Mix Asphalt by Ignition Method
6. ASTM D6931: Standard Test Method for Indirect Tensile (IDT) Strength of Asphalt Mixtures
7. ASTM D7312: Standard Test Method for Determining the Pavement Shear Strain and Complex Shear Modulus of Asphalt Mixtures Using the Superpave Shear Tester

1.04 SUBMITTALS

A. Provide Paving Contractor experience requirements, as outlined in "Quality Assurance" of this specification section, for the following:

1. General Paving
2. Painted Lines and Traffic Markings

B. Provide Asphalt Producer Vendor Certificate and proof of quality control monitoring as outlined in "Quality Assurance" of this specification section.

C. Provide material certificates showing content/mechanical analysis for the following:

1. Asphaltic Concrete Mix Design with Authorization Signature:

a. Type/name of mix (less than 24 months old)
b. All aggregates gradations and quality measurements
c. Plot (0.45 power graph) of the final aggregate blend
d. Bulk (dry) specific gravity of all aggregates and final aggregate blend (Gsb) including worksheets for natural (virgin) as well as reclaimed asphalt pavement (RAP)
e. Grade of asphalt binder (PG) being used
f. Optimum percent asphalt binder (Pb)
g. Mix air voids at optimum (Va)
h. Bulk specific gravity of mix at optimum (Gmb)
i. Theoretical maximum specific gravity of mix at optimum
j. Voids in the Mineral Aggregate (VMA) and Void Filled with Asphalt (VFA)

k. Dust to total asphalt content (AC) ratio
l. All design data and associated design curves

2. Bituminous Tack Coat

D. Provide Manufacturer's Product Data (MPD) for the following:

1. Soil Stabilization Fabric
2. Painted Lines and Traffic Markings
3. Hot Pour Crack Sealing and Filling

E. Provide shop drawings for the following:

1. Painted Lines and Traffic Markings: Shop drawings indicating sizes, shapes, patterns, and colors of markings, including manufacturers and types of paint.
2. Owner to approve all paint colors prior to installation.

F. Submit the following schedules:

1. Paving Schedule, indicating installation date(s), sequence, phasing and coordination.

2. Asphalt Placement Work Plan, indicating: site access, site equipment, permitting, paving limits, phasing, coordination with adjacent contractors, adverse weather or atmospheric conditions, delays or other factors that may affect the paving schedule. Supply Owner with yield calculations for all asphalt paving products and materials used on the project as part of the work plan.

G. Field Quality Control test reports as indicated in this specification section.

1.05 QUALITY ASSURANCE

A. Paving Contractor Experience Requirements:

1. General Paving: Contractor shall have the experience of at least five (5) years in business. Paving superintendent has a minimum of three (3) years' experience as a paving crew operating foreman.

2. Line Striping and Pavement Markings: At least five (3) years in business, and a superintendent/ layout foreman having a minimum of three (3) years' experience

B. Asphalt Testing and Inspection Services:

1. The Owner will employ and pay for the services of an Independent Testing Agency to provide testing and inspections of asphalt pavements.

2. The services and the information provided by the Testing Agency are provided for the sole benefit of the Owner. The information is provided to the Contractor for the sole purpose of being aware of what is being reported.

3. The Contractor is solely responsible for assuring the work complies with the Contract Documents in all respects and may not rely on the testing agency for this or any other assurances. The Testing Agency and their representatives are not authorized to revoke, alter, relax, enlarge, or release any of the requirements of the Contract Documents, approve or accept any portion of the work, perform

or excuse any duties of the Contractor, or be involved in the scheduling of any work.

4. Asphalt paving materials and operations shall be tested and inspected as the work progresses. Failure by the Testing Agency to detect any defective work or material shall not in any way prevent later rejection (when such defect is discovered) nor shall it obligate the Owner for final acceptance.

C. Asphalt producer shall monitor production according to the procedures of NYSDOT Material Method 28 Friction Aggregate Control and Test Procedures. Asphalt producer shall be a New York State approved/certified HMA (Hot Mix Asphalt) manufacturing facility.

D. Calibrated equipment and qualified personnel must be always accessible during the construction of the HMA.

1.06 JOB CONDITIONS

A. Job conditions in Section 312201 apply.

B. Atmospheric conditions for applying courses:

1. Hot mix asphalt shall generally arrive on the project site between 270°-300° F. (per asphalt producer recommendations).
2. Place asphalt concrete wearing course or bituminous surface treatment only when atmospheric temperature is above 50 degrees F. and rising, and when asphalt binder course is thoroughly dry.
3. Place binder course only when air temperature is above 45 degrees F. and rising and when asphalt base course or granular stone base course is thoroughly dry.

C. Grade Control: Establish and maintain required lines and elevations.

D. Codes and Standards: Perform the work in compliance with applicable requirements of governing authorities having jurisdiction. Obtain and pay for permits required by local authorities, (such as: Curb Cuts, Sidewalk Permits, Working within the ROW).

E. Construction Review and Testing: Notify and coordinate with the Independent Testing Agency and Architect when the subgrade is shaped and ready for proof rolling. Also, when the granular base course is fully installed, compacted and ready for density testing. Protect subgrade and subbase at all times.

F. When staging or scheduling delays occur and wearing course cannot be installed directly after binder course installation before winter, provide temporary asphalt transition ramp/collar around drainage structures in paved areas and at handicap ramps to prevent damage by snow plow. Remove prior to installation of wearing course. Power wash surface and apply asphalt tack coat, as specified, prior to wearing course installation, at no additional cost to the Owner.

1.07 DELIVERY, STORAGE, AND PROTECTION

A. Deliver all materials to the job site with all labels intact and legible at time of installation.

B. Store materials off ground under cover. Protect from damage or deterioration.

C. Handle materials to prevent damage to surface, edges, ends and factory applied finishes of items. Damaged material shall be rejected and replaced.

1.08 ASPHALT PRICE ADJUSTMENT

A. Asphalt pricing is based on the NYS Department of Transportation average posted prices for Asphalt Performance Graded Binder (PGB). NYSDOT Website: https://www.dot.ny.gov/main/business-center/contractors/construction-division/fuel-asphalt-steel-price-adjustments

B. Asphalt Price Adjustment: The asphalt price adjustment will be based solely on the price changes for asphalt as determined by the formulas below. No adjustment will be made if the monthly average posted price is within $15.00 of the asphalt index price. No consideration will be given to the situation where an individual supplier's price exceeds the monthly average posted price.

C. Prices: The Asphalt Index Price and Monthly Average Posted Price are defined as follows:

1. Asphalt Index Price: The asphalt index price is a price per ton of Performance Graded Binder (PGB) used solely as a basis from which to compute asphalt price adjustments. The asphalt index price for original contract bid price items and additional work at the original contract bid price will be the monthly average posted price for the month of the bid letting.

2. Monthly Average Posted Price: The average terminal price for unmodified PG 64-22 binder, without anti-stripping agent, determined by the NYSDOT, based on prices of approved primary sources of PGB.

D. Adjustment: Asphalt price adjustment will be based on the following formulas:

1. When price Increases: Price Adjustment = (tons x % asphalt) x (Monthly Average Posted Price – PGB Index Price - $15.00)

2. When price Decreases: Price Adjustment = (tons x % asphalt) x (Monthly Average Posted Price – PGB Index Price + $15.00)

3. Baseline index price shall be based on the month of the contract bid date.

E. Pavement Types and Percent Asphalt*:

37.5mm	Type 1 Base Course	4.8% Asphalt
19.0mm	Type 3 Binder Course	4.8% Asphalt
12.5mm	Type 6 Top Course	5.9% Asphalt
9.5mm	Type 7 Top Course	6.3% Asphalt

* Percentage of Asphalt is approximate and shall be based off actual project submittals provided by the Asphalt Producer.

PART 2 - PRODUCTS

2.01 SOIL STABILIZATION FABRIC

A. Shall be a heavy duty, commercially manufactured woven polypropylene geotextile. Standard of quality shall be Mirafi 500X, manufactured by TenCate or Architect approved equal.

2.02 GRANULAR BASE COURSE AND GRAVEL PAVEMENT

A. Shall be as specified in Section 312201.

B. The graded and designed granular base below all new Asphaltic Concrete Pavements shall be constructed, tested, and prepared in accordance with Section 312201 - Site Earthwork of the Contract Documents.

2.03 ASPHALTIC CONCRETE

A.

Pavement Types	Percent Asphalt*
37.5mm Type 1 Base Course	4.8% Asphalt
19.0mm Type 3 Binder Course	4.8% Asphalt
12.5mm Type 6 Top Course	5.9% Asphalt

* Percentage of Asphalt is approximate and shall be based off actual project submittals provided by the Asphalt Producer.

B. Hot Mix Asphalt Top Course: Pavement shall meet the minimum requirements for 12.5 mm (Type 6) SUPERPAVE Hot Mix Asphalt Top Course (75 gyrations), with a PG 64-22 Binder as specified in Section 402, of the current NYSDOT Standard Specifications, with the exception that the maximum proportion of Recycled Asphalt Pavement (RAP) to virgin aggregates shall not exceed 15% of the total mix.

C. Hot Mix Asphalt Binder Course: Pavement shall meet the minimum requirements of 19.0mm SUPERPAVE Hot Mix Asphalt Binder Course (75 gyrations), with a PG 64-22 Binder, as specified in Section 402, of the current NYSDOT Standard Specifications, with the exception that the maximum proportion of Recycled Asphalt Pavement (RAP) to virgin aggregates shall not exceed 20% of the total mix.

D. Hot Mix Asphalt Base Course: Pavement shall meet the minimum requirements of 37.5mm SUPERPAVE Hot Mix Asphalt Base Course (75 gyrations), with a PG 64-22 Binder, as specified in Section 402, of the current NYSDOT Standard Specifications, with the exception that the maximum proportion of Recycled Asphalt Pavement (RAP) to virgin aggregates shall not exceed 20% of the total mix.

E. The coarse aggregate used in HMA shall be sound, angular crushed stone or crushed gravel. The fine aggregate shall be well graded, moderately sharp to sharp (angular) sands.

2.04 BITUMINOUS TACK COAT

A. Material shall consist of an asphalt emulsion, Grade RS-1h, and shall meet the minimum requirements of Section 407, of the current NYSDOT Standard Specifications. Bituminous Tack Coat shall be installed over all new and existing concrete and asphalt pavements and structures prior to the installation of new Hot Mix Asphalt materials. The following application rates shall apply:

1.	New Hot Mix Asphalt	0.05-0.07 gal/sy
2.	Milled Surfaces of Existing Asphalt	0.10-0.15 gal/sy
3.	Abutting Vertical Edges (drainage structures, appurtenances)	0.05-0.07 gal/sy
4.	All Styles of Curbs and Gutters	0.05-0.07 gal/sy
5.	Delayed asphalt installation of HMA Courses	0.10-0.15 gal/sy

2.05 PAINTED LINES AND TRAFFIC MARKINGS

A. The extent of the pavement markings shall match the extent, location and composition of pavement markings existing at the site prior to start of work where applicable.

B. The work includes but is not limited to the following: parking stall divider lines, wheelchair legends, “STOP” legends, “NO PARKING” legends, striping and legends, directional arrow legends, diagonal striping, center line, and other pavement markings as may be shown on the plans.

C. Provide ready-mixed, one component waterborne traffic line paint. Standard of quality shall be: Pro-Park® Waterborne Traffic Marking Paint B-97 Series as distributed through Sherwin-Williams, 800-474-3794; or Architect approved equal.

1. Colors (as approved by the Owner in writing):

a.	Yellow:	1 Gallon & 5 Gallon, Product Number B97YD2467
b.	White:	1 Gallon & 5 Gallon, Product Number B97WD2434
c.	Blue:	1 Gallon & 5 Gallon, Product Number B97LD2022
d.	Black:	1 Gallon & 5 Gallon, Product Number B97BD2021

2. Paints shall contain all necessary co-solvents, dispersants, wetting agents, preservatives and all other additives, so that paint shall retain viscosity. Halogenated solvents and glass beads shall not be permitted.

3. Volatile Organic Compound (VOC) content shall not exceed 250 grams maximum per liter of paint as determined in accordance with ASTM D 3960 test, excluding water and exempt solvents.

2.06 HOT POUR CRACK SEALING AND FILLING

A. Single component, hot applied asphalt crack and joint sealant capable of withstanding temperatures of up to 450° without experiencing polymer degradation.

B. Shall be supplied in solid blocks comprised of heat stabilized polymers and asphalt.

C. Meeting the following material requirements when tested in accordance with ASTM D5329. (See chart below)

Chemical & Physical Analysis

Recommended Application Temperature	350-400°F
Maximum Heating Temperature	450°F
Cone Penetration at 25°C	50 max.
Flow at 60°C, mm	0.
Softening point	200°F Min.
Flexibility 0°F	(1" Mandrel)-Pass
Specific Gravity	1.17
Asphalt Compatibility	Passes

D. Standard or quality shall be Crack Master Supreme as manufactured by Thorworks Industries, Inc., 800-395-7325, www.thorworks.com or approved equal.

2.07 ASPHALT SEALER (UNIT PRICE)

A. Product Description: A mineral filled asphalt emulsion pavement sealer fortified with special surfactants to promote superior adhesion and durability. Select aggregate is job-mixed to produce a slip-resistant coating.

B. Technical Data: Meeting the requirements of ASTM D 6937, ASTM D 6930, and ASTM D 2172 for asphalt based emulsion pavement sealer.

C. Environmental Considerations: Shall contain no asbestos. Environmentally friendly asphalt based pavement sealer containing less than fifty (50) grams per liter volatile organic content (VOC).

D. Physical Properties: The following material requirements when tested in accordance with ASTM D 5, ASTM D 113, ASTM D 36, ASTM D 93, ASTM D 4060, and ASTM D 2939 procedures.

E. Standard of quality: Masterseal Concentrate Asphalt Based Pavement Sealer as manufactured by Seal Master 800-395-7325, www.sealmaster.net or Architect approved equal.

F. Additive: Is a water based copolymer latex emulsion. Meeting the performance requirements of ASTM D 4866 specification for latex additive used in asphalt based emulsion pavement sealer. Standard of quality shall be Top Tuff Pavement Sealer Additive as manufactured by Thorworks Industries, Inc., 800-395-7325, www.thorworks.com.

G. Sand shall be thoroughly clean, 100% passing 40 to 70 mesh, AFS rating.

PART 3 - EXECUTION

3.01 PREPARE SURFACE

A. Prior to commencement of asphalt paving, all excavations, drainage, utilities, backfilling, fencing, bollards, storm structures, curbing installations, adjustments, proof-rolling and density test procedures shall be complete to the satisfaction of the Architect.

B. Prior to commencement of tack coat and asphalt paving within pavement milled areas, as shown on the plans, all cracks and joints in the milled pavement surface shall be prepared and filled in accordance with the project specifications. Any oil or grease spots shall be scraped and treated to prevent bleeding through the tack coat.

C. Saw cut, using straight and true lines, all existing asphalt pavements to remain in place with straight, neat edge for abutting against proposed asphalt pavement.

D. Provide and confirm field quality control as described in Section 312201 for pavement subgrade and granular base course stone.

3.02 CONSTRUCT PAVEMENT GRANULAR BASE COURSE

A. General: Consists of placing granular base course material, in layers of specified thickness, over prepared subgrade and fabric to support a pavement course.

B. Grade Control: Provide engineering layout per Section 312201 and grade stakes. During construction, protect grade stakes; maintain lines and grades including crown and cross-slope of each course.

C. Install soil stabilization fabric after subgrade has been acceptably compacted and proof rolled. Install soil stabilization fabric as recommended by the manufacturer AND;

1. Lay fabric in direction of construction traffic.

2. Overlap fabric side to side and end to end a minimum of two (2') feet.

3. Establish reasonable compaction and rut stability before using heavy or vibratory compaction equipment.

D. Placing:

1. Place granular base material over soil stabilization fabric, on prepared subgrade in layers of uniform thickness, conforming to the asphalt pavement details on the drawings.

2. Place granular base material in a maximum of six (6) inch layers and compact with a vibratory or 10-ton smooth wheeled roller.

E. Provide density testing as described in Section 312201.

F. Surface Smoothness: Test finished surface for smoothness. Surface will not be acceptable when it deviates more than 3/8" measured by a 10-foot straightedge, in any direction.

G. The finished grade of the granular base course shall be verified to ensure that the final finished product of the bituminous concrete pavement surface will be installed to the lines and grades of the existing pavements and proposed elevations surveyed by the Contractor prior to the start of the paving work.

3.03 PLACE ASPHALT MIX

A. General:

1. The Contractor shall submit a paving plan, indicating intended direction of paving, number of pulls, etc. for approval prior to the start of paving operations.

2. Joints: Saw cut vertical straight, neat edges for joints required. Joints shall be sharp and clean, conforming to shapes drawn on drawings. Ragged joints will not be accepted.

3. Mill, (key) two (2') feet into surface of adjacent asphalt so joints do not line up or "stack".

4. Place bituminous tack coat to all surfaces as indicated in this specification. When pavement surface temperature is above or below the 75-130 degrees F. range, the grade of asphalt emulsion must be modified according to NYSDOT standards. Tack coat shall not be applied to a wet surface or when the pavement surface temperature is below 45 degrees F.

5. Place asphalt on approved prepared surface, spread and strike-off.

6. Spread mixture at minimum temperature of 225-240 degrees F. Place inaccessible and small areas by hand. Hand work shall be minimized to ensure the best possible finished surface.

7. Place each course to required grade, cross-section, and compacted thickness.

8. Paving operations shall not be scheduled when ample time does not exist to place, compact, and finish roll the hot mix asphalt during daylight hours and prior to rainfall.

B. Pavement Placing: Shall be installed in accordance with Section 402-"Hot Mix Asphalt (HMA) Pavements", of the current NYSDOT Standard Specifications.

C. Paving Equipment:

1. Must be capable of placing, spreading and finishing courses of HMA to the specified thickness.

2. HMA shall be free of marks, segregation and be placed to the required uniform elevation with a smooth texture not showing tearing, shoving, or gouging.

3. Auger extensions are required while pavers are extended beyond the basic screed width.

4. Paving equipment shall be self-propelled and capable of maintaining the line and grade shown on the plans with suitable electronic equipment. The screed shall be straight and true with no bow and utilizing a vibratory screed. Paving equipment should have fully functional screed heaters and joint preheaters.

D. Asphaltic Concrete shall be installed as follows:

1. Light Duty Pavement: Installed in two (2) lifts consisting of 19.0mm SUPERPAVE Hot Mix Asphalt Binder Course overlain by 12.5mm SUPERPAVE Hot Mix Asphalt Top Course.

2. Medium Duty Asphalt Pavement: Installed in two (2) lifts consisting of 19.0mm SUPERPAVE Hot Mix Asphalt Binder Course overlain by 12.5mm SUPERPAVE Hot Mix Asphalt Top Course.

2. Heavy Duty Asphalt Pavement: Installed in three (3) lifts consisting of a 37.5mm SUPERPAVE Hot Mix Asphalt Base Course overlain by 19.0mm SUPERPAVE Hot Mix Asphalt Binder Course overlain by or 12.5mm SUPERPAVE Hot Mix Asphalt Top.

4. Heavy Duty Asphalt Pavement - DOT: Installed in four (4) lifts consisting of two lifts of 37.5mm SUPERPAVE Hot Mix Asphalt Base Course overlain by 19.0mm SUPERPAVE Hot Mix Asphalt Binder Course overlain by or 12.5mm SUPERPAVE Hot Mix Asphalt Top.

E. Place in strips not less than ten (10') feet wide, unless otherwise acceptable. In placing each succeeding pass after the placement of the initial pass, the screed of the paver shall be set such that it overlaps the preceding pass by 6" and be sufficiently high such that when compacted, a smooth joint is produced. Prior to pinching the joint, the excess material shall be pushed onto the edge of the new pass with a lute. Excess material shall be removed.

F. After first lift has been placed and rolled, place succeeding lifts and extend rolling to overlap previous lifts. Where possible, top course shall be placed at right angles to binder course and in the direction that the drainage flows. Where this is impractical, offset joints of the two courses by a minimum of two (2') feet so upper and lower joints do not align.

G. For pavement placing on the running track and field events: the paver shall be equipped with and utilize both automatic (laser controlled) grade and slope control to maintain required tolerances. Pavement of running track oval passes shall be continuous. Paving equipment shall be equipped with sonar pods or no contact skis for athletic asphalt construction.

3.04 ROLL ASPHALT MIX

A. General:

1. Rollers shall conform to the manufacturer's specifications for all ballasting. At least one vibratory roller shall be required for each project, with two rollers required as a minimum. (Three rollers shall be required when tonnage is greater than 300 tons/day.)

2. Rollers shall be of a good condition and capable of compacting the HMA to the minimum in-place density required by this specification. Compact asphalt with a nominal 10-ton steel wheel roller or pneumatic rubber-tired roller. Compact mixture with hot hand tampers or vibrating plate compactors in areas inaccessible to rollers.

3. Begin rolling when mixture will bear roller weight without obvious or excessive displacement.

B. Finish Rolling: Each lift of the Asphaltic Concrete Pavement shall be mechanically rolled and compacted to the finished thicknesses specified in the Contract Documents. The pavements shall be compacted to a minimum of 94%-97% (95%-102% at longitudinal joints) of the materials theoretical density as determined by AASHTO Method T 209 and an air void percentage of 5%-6% maximum.

C. Patching: Remove and replace paving areas mixed with foreign materials, dirt, and defective areas. Cut-out such areas and fill with fresh, hot asphalt concrete. Compact by rolling to maximum surface density and smoothness.

D. Joints:

1. The Contractor shall sequence the installation and orientation of all Asphaltic Concrete Pavements such that the minimum numbers of longitudinal and transverse joints are produced and in accordance with the approved Asphalt Placement Work Plan.

3. Neat, straight butt joints between successive passes. Offset joints a minimum of six (6") inches between lifts of asphalt.

3. When repairs or staging of work occurs, make neat vertical saw cut between old and new work to create butt joint. Heat joint prior to pouring. Cold joints are <u>not</u> acceptable.

4. Apply bituminous tack coat to all surfaces and rates indicated under "Bituminous Tack Coat" of this specification section. Tack coat shall not be required on abutting vertical edges for pavements placed in the same day.

5. Minimize construction, longitudinal, and transverse joints left open for an extended period of time.

6. Construct longitudinal joints by paving in a hot fashion with a temperature of not less than 220°F to ensure maximum performance and adhesion.

7. Compact all joints to provide for a neat, uniform and tightly bonded joint that will meet both surface tolerances and density requirements of this specification.

8. Cut straight and true (vertical construction or transverse joints if the material has cooled to less than 220°F prior to the placement of the next pass to ensure the best performing joint possible.

F. Edges: Roll at 45 degrees as detailed, creating clean edge conforming to shapes indicated on the drawings. Ragged edges will not be accepted. Return and saw cut ragged edges at no additional cost to the Owner as directed by the Architect.

G. The final finished grades of the new Bituminous Concrete Pavements must be smooth and true to the contours and shall be installed to the lines and grades of the site prior to start of construction. The final finished grades shall match adjacent pavement surfaces and concrete slabs, aprons, and doorways.

H. Construction Delays (over 48 hours): When placement of the wearing course over the binder course is delayed over 48 hours, thoroughly clean existing surface of dirt, oil and other debris by pressure washing and sweeping. Place bituminous tack coat as specified in this section.

3.05 ASPHALT TOLERANCES

A. Thickness and Density: Compact each asphalt course to produce the thickness indicated on the drawings within the following tolerances:

1. Base Course: Plus or minus 1/2-inch
2. Binder Course: Plus or minus 1/4-inch
3. Wearing Course: Plus or minus 1/8-inch

B. Surface Smoothness: Compact each course to produce a surface smoothness within the following tolerances as determined using a 10-foot straightedge applied transversely or longitudinally to paved areas:

1. For Asphalt Concrete:

Base Course Surface: 3/8"
Binder Course Surface: 1/4"
Wearing Course Surface: 1/8"

C. Asphalt Cores: Shall be provided as indicated under "Field Quality Control" of this specification,

3.06 FIELD QUALITY CONTROL

A. The Owner’s Testing Agency shall provide the following in the daily report at a minimum:

1. Verify the following for the asphalt mix design prior to asphalt placement:

a. The asphalt mix design has been approved.
b. The asphalt mix design specifies the minimum relative compaction and the methods required to determine maximum density.

2. Verify the asphalt subgrade has been acceptably proof rolled. (See Section 312201.)

3. Inspect /test aggregate base course material for in-place density (95%) and thickness. Test materials for gradation classification, and physical properties. (See Section 312201.)

4. Inspect/test asphalt wearing course material for compaction during placement and conduct thickness measurements during lay-down. Take temperature of the asphalt mixture and compare actual temperature with the approved asphalt mixture design range. As a minimum, perform the following inspection/tests:

   a. Collect trip tickets from trucks delivered to the site and verify correct mix design being used for the project.
   b. Temperature tests: one per truck.
   c. Lay down thickness (uncompacted): one per strip or 500 square feet minimum
   d. Verify equipment rolling pattern and passes to ensure proper compaction: one per day
   e. Density test (daily lab density): one test per 5000 square feet minimum
   f. Hot mix samples (laboratory testing for density per ASTM D1188): one per day
   g. Thickness per ASTM D3549 and density samples per ASTM D2950 by a properly calibrated nuclear asphalt testing device. If there is a disagreement between tests done by ASTM D2950 and ASTM D1188, the values done by ASTM D1188 will govern: one test per 20,000 square feet (surface lift), one test per 10,000 square feet (base lift)
   h. Air voids per ASTM D3203 or D2726: one test per 5000 square feet minimum
   i. Verify compaction at the joints and seams. The completed paved surface to be true to grade and cross section. Verify smoothness by using an unleveled 10-foot straightedge and ensuring no gap at any point between straightedge and pavement exceeds surface smoothness requirements above except at interception or at changes of grade.
   j. The screed/lay down thickness tolerance shall be between 1/8 to 3/16 inches greater than the required asphalt minimum layer requirement. When screed depth is set for the exact thickness as specified, immediately notify the Owner’s Representative and Contractor that the installed asphalt thickness may be deficient to achieve the specified minimum thickness. Identify areas of non-complying thickness and attach a drawing identifying the areas to the daily field report.
   k. Immediately notify the Owner’s Representative and Contractor when paving is being conducted in cold weather and asphalt temperatures are below or above the design mix range.
   l. Check the surface grades and drainage patterns. Identify on a drawing all paved areas that are holding water after asphalt placement and notify the Owner’s Representative and Contractor. Small ponding areas (bird baths) larger than two (2') feet in any dimension are not acceptable. When this test proves that surface conditions are not acceptable, the Contractor will be responsible for correcting the problem areas. Install a one (1") inch shim coat of wearing course material, or other means acceptable to the Architect.

m. Verify tack coat and edge coat have been applied at the proper rate.

5. Asphalt Cores: *(Per the judgment of the Architect).*

a. Prior to final acceptance of the asphalt and before lining or other surface materials (resilient track surfacing, etc.) are placed, the Owner's Testing Agency shall core 3" diameter areas of the asphalt surfacing where directed by the Architect. Consistency, density, thickness, and tensile strength per ASTM D6931 will be evaluated.
b. Patch core areas as directed by the Architect to match adjacent density, texture and thickness.
c. Coordinate day to day scheduling with the Testing Agency.
d. If cores vary significantly from the contract requirements, additional cores will be performed by the Testing Agency as directed by the Architect. Once the overall general quality is determined, provide remedial work as directed by the Architect to achieve the quality and consistence as specified.

B. Unacceptable Paving: Remove and replace unacceptable paving as directed by the Architect, immediately and without argument or delay. Correction of deficient areas in the wearing course shall be done by sawcutting and removal of defective area of work. Tack coat shall be applied to all edges and the pavement shall be replaced. Shimming or skin patching of the wearing course shall not be permitted. Correction of deficient areas within the binder course shall be corrected by sawcutting and milling high spots, and truing and leveling low spots or as directed by the Architect.

3.07 SURFACE PROTECTION

A. Protection: After final rolling and sealing, do not permit any type of vehicular or construction traffic on pavement until it has cooled and hardened as recommended by the producer/manufacturer, minimum of 48 hours.

B. Provide protection including, but not limited to, fencing, traffic cones, barrels, lights, reflective signs, flag-persons and barricades until mixture has cooled and attained its maximum degree of hardness.

3.08 PAINTED LINES AND TRAFFIC MARKINGS

A. Cleaning: Sweep and clean surface to eliminate loose material and dust. Remove dirt, oils and other foreign matter. All surfaces to receive pavement markings shall be clean and in good condition to accept pavement markings.

B. Coordinate provisions for installation with work of other trades.

C. Locate to alignment and dimensions as shown on drawings and/or approved by Owner.

D. Painted markings shall meet regulations described in the "Manual of Uniform Traffic Control Devices", latest edition, as published by NYSDOT, Division of Traffic and Safety, Section 262.25 and figure PM-42; and they shall comply with the most recent version of the Americans with Disabilities Act Standards for Accessible Design.

E. Protect: Adjacent surfaces and other items to remain with tape, drop cloths, or another Architect approved means.

F. Application: Two coats according to manufacturer's recommendations resulting in a dense, opaque application without any ghosting of former pavement markings showing

through. Overspraying along edges will not be accepted. Edges shall be sharp and crisp, to the shapes required by the drawings.

1. First coat shall be installed at the recommended DFT (dry film thickness) after paving is in place. The second coat shall be applied at the recommended DFT no later than thirty (30) days after the completion of work.

2. Apply paint materials using clean brushes, rollers or spraying equipment.

3. Apply paint materials as a rate not exceeding those recommended by the paint manufacturer for surfaces being painted, less 10% of losses

4. Comply with manufacturer's recommendations for drying time between coats. The minimum DFT must be met. Apply additional coats as needed to achieve minimum total specified DFT of the paint system.

5. The minimum required total Dry Film Thickness (DFT): The DFT shall be the minimum required thickness as measured in mils.
6. System coverage requirements minimum total thickness (unless otherwise noted):

    a. 1st Coat – 3.0 mils
    b. 2nd Coat – 6.0 mils

7. Exterior Paint Systems: Provide the following paint systems as indicated: (Colors to be approved by Owner.)

    a. Parking stall, division and limit lines shall be 4" in width, true and straight. Color: White – DFT 6.0 mils
    b. Pavement lettering "NO PARKING" shall be 2'-0" in height. Color: Yellow – DFT 6.0 mils
    c. Compact lettering "COMPACT" shall be 1'-0" in height. Color White – DFT 6.0 mils
    d. Stop legends shall be as detailed on drawings. Color: White – DFT 6.0 mils
    e. Wheelchair legends shall be as detailed on the drawings. Color: Blue background with white symbols. Parking stall striping shall be Blue at handicap stalls only – DFT 6.0mils
    f. Diagonal striping Handicapped. Color: Blue – DFT 6.0 mils
    g. Diagonal striping Loading Zone. Color: Yellow – DFT 6.0 mils
    h. Directional signage shall be as detailed on the drawings. Color: White – DFT 6.0 mils
    i. Center line striping shall be 4" in width as detailed on the drawings. Color: White – DFT 6.0 mils
    j. Fire line striping shall be 4" in width. Color: Yellow – DFT 6.0 mils

G. Allow 48 hours minimum curing time for paint before allowing traffic on surfaces. Clean up thoroughly including all protective tape, spilled paint, and debris. All parking area marking and painting to be protected by appropriate traffic barriers, lighted if necessary, so located as to prohibit parking and traffic until traffic lines are completed and properly dry.

3.09 HOT POUR CRACK SEALING AND FILLING

A. The crack must be free from moisture, dust, and loose aggregate. Routing or wire brushing are preferred methods followed by a compressed air heat lance immediately prior to sealing. The substrate and air temperature must be above 45°F.

B. Shall be melted in direct fired or oil jacketed melters. Material should reach recommended pouring temperature of 350-400°F. Fresh material may be added as sealant is used.

C. Apply heated crack filler using either a pump and wand system or a pour pot. For best results the sealant depth to width ratio should not exceed 2 to 1 (i.e. 2-inches deep to 1-inch wide). The cooled sealant height should not exceed 1/8" above surrounding pavement. Using a sealing shoe or squeegee, band the material 2 to 3 inches wide over the crack.

3.10 ASPHALT SEALER (Unit Price - Limits approved by Owner)

A. Thoroughly clean existing surface of dirt, oils and other debris by power washing and sweeping. Remove weeds and debris from cracks and fill with hot pour crack sealant NYSDOT as recommended by the manufacturer, flush with grade.

B. Asphalt Based Pavement Sealer shall be mixed in accordance with the following mix design (based on 100 gallons for ease of calculation). Contractor to adjust amount based on actual square yards to be applied:

Asphalt Based Concentrate	100 gals
Water	15-25 gals
Sealer Additive	2 gals
Sand*	400 lbs

*40-70 mesh AFS rating

C. Apply three (3) coats properly mixed Asphalt Based Pavement Sealer (Asphalt Based Concentrate, Water, Sand, Additive) at a rate 0.11 to 0.13 gallon per square yard (70-82 square feet per gallon) per coat. NOTE: The sealer is not designed to be a depression filler and shall not exceed a total depth of 3/16" for the two coats.

D. Both surface and ambient temperature shall be a minimum of 50°F. Temperature shall not drop below 50°F in a 24 hour period following application. New asphalt surfaces shall be allowed to cure a minimum of four weeks under ideal weather conditions (70°F) before applying Asphalt Based Concentrate Sealer.

3.11 CLEAN UP

During the contract, and at intervals as directed by the Architect, and as asphalt paving is completed, clear the site of extraneous fabric, gravel, asphalt and debris. Leave the site in a clean, safe, well draining, neat condition.

END OF SECTION 32 12 01

SECTION 32 13 01
SITE CONCRETE WORK

PART 1 - GENERAL

1.01 DESCRIPTION OF WORK

A. The extent of site concrete work is shown on the drawings and includes formwork, reinforcement, accessories, cast in place concrete, installation of embedded items, finishing, curing, mix designs, testing and acceptance requirements for concrete.

B. Site Concrete work includes, but is not limited to, the following:

1. Concrete walks, pads and ramps
2. Concrete curbs (slip-form)
3. Concrete curb ramps with detectable warning system
4. Concrete footings, bases, foundations,
5. Miscellaneous concrete for cradles, saddles, collars and thrust blocks, (if reqd.)
6. Reinforced concrete retaining walls with form liner
7. Concrete scheduling April 1 to October 15
8. Clean up

C. Provide materials, labor, equipment and services required to accomplish related work in accordance with the drawings and specifications.

1.02 RELATED WORK SPECIFIED ELSEWHERE

A. Section 312201 - Site Earthwork

B. Section 323000 Series - Fencing, Flagpoles, Signs, etc.

C. Section 334001 - Storm Drainage

1.03 REFERENCES

A. ACI 301-96 - Specifications of Structural Concrete for Buildings

B. ASTM A615 - Deformed and Plain Billet-Steel for Concrete Reinforcement

C. ASTM C31 - Standard Practice for Making and Curing Test Specimens in the Field

D. ASTM C33 - Concrete Aggregate

E. ASTM C39 - Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens

F. ASTM C94 - Ready-Mixed Concrete

G. ASTM C109 - Test Method for Compressive Strength of Hydraulic Cement Mortars

H. ASTM C143 - Standard Test Method for Slump of Hydraulic Cement Concrete

I. ASTM C1107 - Standard Specification for Packaged Dry, Hydraulic-Cement Grout (Non-Shrink)

J. ASTM C150 - Portland Cement

K. ASTM C172 - Standard Practice for Sampling Freshly Mixed Concrete

L. ASTM C173 - Standard Test Method for Air Content of Freshly Mixed Concrete by Volumetric Method

M. ASTM C260 - Air Entraining Admixtures for Concrete

N. ASTM C309 - Liquid Membrane-Forming Compounds for Curing Concrete

O. ACI 315 - Details and Detailing Concrete Reinforcement

1.04 SUBMITTALS: (See Section 311201, 1.5)

A. Shop Drawings required for concrete steps, retaining walls, and pads showing reinforcing sizing and spacing.

B. Manufacturers Product Data (MPD) and Samples where indicated are required for the following:

1. Expansion Joint and Sealant Caulk, MPD and Color Samples
2. Water Based Curing Compound
3. Slip Dowel System
4. Fiber Reinforcement: (NYSDOT Type J Curbs Only)
5. Cold Weather Admixture
6. Hot Weather Admixture
7. Air Entrainment
8. Detectable Warning System
9. Form Release
13. Exterior Anchoring Cement Non-Shrink Grout
14. High Strength Anchoring Epoxy System
15. Retaining Wall Form Liner

C. Submit proposed 4,000 psi concrete mix design and test data in accordance with ACI 301 to the Architect for review prior to commencement of the work.

1. Indicate the locations and elements for which the mix will be used.

2. Include in the concrete mix design all required or proposed admixtures necessary to facilitate the installation of the concrete by the means and methods selected by Contractor for this project.

D. Mill test certificates and/or test reports for cement indicating compliance with these specifications.

1.05 QUALITY ASSURANCE

A. Concrete Testing Services: The Owner shall employ an acceptable independent testing laboratory to perform materials evaluation, testing of concrete mixes, and quality control testing. Coordinate day-to-day scheduling with the testing agency. The field technician shall be ACI Certified Grade 1 Field Technician.

B. Construct and erect concrete formwork in accordance with ACI 301 and 347.

C. Perform concrete reinforcing work in accordance with ACI 301.

D. Perform cast-in-place concrete work in accordance with ACI 301.

E. Conform to New York State Building Code.

F. Field quality control tests are specified in Part 3 - Execution.

1.06 JOB CONDITIONS

A. Job conditions in Section 312201 apply. Provide ample and skilled manpower for concrete installation which is a recognized time sensitive procedure.

B. All concrete work shall conform to American Concrete Institute (ACI) 304R-00 "Guide for Measuring, Mixing, Transporting and Placing Concrete".

C. Do not install concrete work when the temperature of the outside air is below 50 degrees F. and falling unless suitable means acceptable to the Architect are provided to protect work from cold and frost and ensure that mortar and concrete will cure without freezing as indicated in "Cold Weather Concreting" below.

D. Cold Weather Concreting: Provide non-chloride accelerating water reducing admixture in site concrete work placed at ambient air temperatures below 50 degrees F. (10 degrees C.). Comply with International Masonry Industry All-Weather Council cold weather construction and protecting recommendations and American Concrete Institute 306R-10 "Guide to Cold Weather Concreting."

E. Hot Weather: Provide water reducing retarding admixture in site concrete work placed at ambient air temperatures above 80° F. Comply with American Concrete Institute 305R-10 "Guide to Hot Weather Concreting."

F. Construction Review: Notify the Architect/Geotechnical Engineer when stairs, retaining walls, walks, ramps, curbs and pads are formed and ready to receive concrete. Radius form layout shall be inspected and approved by the Architect.

G. Schedule: Unless otherwise directed in writing by the Architect, construct site concrete work from April 1 to October 15. This permits a minimum 30 day dry curing period prior to possible application of deicing chemicals or inclement weather conditions.

H. Site concrete work performed between October 16 and March 30 will require Architect approval, and cold weather concreting practices including an additional written one (1) year guarantee.

1.07 ADA REQUIREMENTS

A. GENERAL: Concrete work shall comply with the Americans With Disabilities Act as described in the 2010 ADA Standards issued by the Department of Justice (DOJ) and the Department of Transportation (DOT) or latest edition, shall be used.

B. Curb ramp and concrete walk surfaces shall meet the following tolerances:

1. Transitions from ramps to walks, gutters, or streets shall be flush and free of abrupt changes.

2. Thresholds at doorways shall not exceed 3/4" in height for exterior sliding doors or 1/2" for other types of doors. Raised thresholds and floor level changes at accessible doorways shall be beveled with a slope no greater than 1:2.
3. Detectable warning system shall cast in place for the safety and convenience of the visually impaired.
4. Sidewalk cross-pitch 2% maximum.

PART 2 - PRODUCTS

2.01 FORM MATERIALS AND ACCESSORIES

A. Forms: Either steel or wood, exterior type softwood, PS1, of size and strength to resist movement during concrete placement and to retain horizontal and vertical alignment until removal. Use forms that are straight and free of distortion and defects, extending the full depth of concrete. Concrete walks which require radius form work shall be set with flexible forms, conforming to the shapes and dimensions as indicated.

B. Lumber: PS 20.

C. Form Ties: Snap-off, metal type of fixed length, cone type.

1. Ties shall be left in place and equipped with swaged washers or other approved devices to prevent seepage of moisture along the tie.
2. Depth of Breakback: Minimum one (1") inch.
3. Unless otherwise noted, provide form ties, which will not leave holes larger than one (1") inch diameter in concrete surface.

D. Dovetail Anchor Slot: Galvanized steel, form filled, release tape sealed slots; bend tab anchors.

E. Form Release Agent: Shall be non-staining and non-residual. Euclid Chemical, Sika, Sonneborn or equal.

2.02 REINFORCEMENT MATERIALS

A. Reinforcing Steel: ASTM A615, 60 ksi yield grade; deformed billet steel bars, plain finish, free of rust and/or oxidation. Reinforcing bars shall be bundled and tagged with grades and suitable identification markings, shall be waterproof, and shall not be removed until steel is placed.

B. Steel Welded Wire Reinforcement ASTM A185, plain type:

1. Flat Sheets
2. Mesh size: 6 x 6 (standard W1.4 x W1.4, heavy duty W2.1 x W2.1)
3. Free of rust and/or oxidation

C. Reinforcement Accessories:

1. Tie Wire: FS QQ- W-461 G, annealed steel, back, 16-gage minimum.
2. Chairs, Bolsters, Bar Supports, Spacers: Sized and shaped for adequate support of reinforcement during concrete placement. They shall provide sufficient supports at close enough spacing so that the steel will carry the weight of the workmen and the fresh concrete without deformation from its specified location.

D. Fabricate concrete reinforcing in accordance with ACI 315.

E. Slip Dowels: Shall be a slip dowel system comprised of a round dowel sleeve and corresponding base. Standard of quality: shall be Speed Dowel as distributed by A.H. Harris, (860) 216-9500 or Architect approved equal.

2.03 CONCRETE MATERIALS

A. Cement: ASTM C150, Normal-Type 1 or Type II, Portland type.

B. Aggregates (ASTM C33):

1. Fine aggregates: clean, sharp, natural sand.
2. Coarse Aggregates: 3/4" maximum size stone meeting the requirements of New York State Department of Transportation Specification 703.02.

C. Water: Clean and not detrimental to concrete.

2.04 ADMIXTURES

A. Calcium Chloride in concrete is prohibited.

B. Air Entrainment Admixture: ASTM C260, Darex AEA ED or Architect approved equal.

C. Water Reducing Admixture: ASTM C494, Type A; not containing more chloride ions than are present in municipal drinking water.

D. High Range Water Reducing Admixture: ASTM C494, Type F or G; not containing more chloride ions than are present in municipal drinking water.

E. Cold Weather Accelerating Admixture: (Ambient temperature below 50°F.) Non-chloride water reducing accelerating admixture, ASTM C494, Type C, PolarSet as manufactured by WR Grace & Co. or Architect approved equal. Mix at rates recommended by the manufacturer. No reduction in compression rating of the concrete is permitted.

F. Hot Weather Water Reducing and Retarding Admixture: (Ambient temperature above 80° F.) Shall be Daratard series admixture, ASTM C494, Type D, as manufactured by WR Grace & Co. or Architect approved equal. Mix at a rate recommended by the manufacturer. No reduction in compression rating of the concrete is permitted.

2.05 RELATED MATERIALS

A. Expansion Joints:

1. For Radius Applications: Expansion joint filler shall be polyethylene closed cell backing with peel off strip, Sonolastic as manufactured by Sonneborn or Architect approved equal.
2. For Straight Applications: Expansion joint filler shall be fiber expansion joint with peel off snap-cap, as manufactured by W.R. Meadows or Architect approved equal.

B. Caulking for flat slabs shall be one part elastomeric self leveling polyurethane gray sealant Masterseal SL1 or Architect approved equal. Caulking for vertical surfaces shall be one component elastomeric gun grade polyurethane sealant Masterseal NP1, color as selected by the Owner to match wall stain or Architect approved equal.

C. Fiber Reinforcement for Concrete Gutters and Curbs: Shall be Grace Fibers ¾" long, fibrillated polypropylene fibers as manufactured by WR Grace & Co. or Architect approved equal. Add fibers to concrete at the rate of 2.0 lbs/c.y. and as recommended by the manufacturer.

2.06 COMPOUNDS, HARDENERS, AND SEALERS

A. Water Based Curing Compound: ASTM C309, Type 1, clear or translucent. Standard of quality shall be Kure-N-Seal as manufactured by Sonneborn or Architect approved equal

2.07 CONCRETE MIX

A. Mix and deliver ready-mix concrete in accordance with ASTM C94.

B. Concrete:

1. Compressive Strength (Minimum at 28 days): 4,000 psi
2. Slump (Maximum): 2 to 4 inches
3. Air Entrainment: 5-8.5%
4. Flexural Strength (ASTM C78): 650 psi at 28 days.

C. Use water-reducing admixture in all concrete.

D. Water/Cement Ratio: Maximum 0.42 for 4,000 psi concrete.

E. Cement Factor Per Cubic yard: Minimum 560 lbs. for 4,000 psi concrete.

1. Substitution of fly ash for cement is prohibited.

F. Maximum Size of Coarse Aggregate:

1. General Work: Per ACI 301, 3/4" maximum.

G. Select admixture proportions for normal weight concrete in accordance with ACI 301.

H. Add air-entraining agent to concrete mix for all concrete work exposed to exterior.

2.08 MIXING WATER CONTROL

A. The quantity of mixing water used in the concrete mix shall be determined by the Contractor, except that the Architect/Geotechnical Engineer may direct that such quantity of water be reduced if the slump of the concrete exceeds the specified slump. The Contractor's determination of the quantity of mixing water shall conform to the various limits on water/cement ration and slump specified. Concrete consistency shall be uniform from batch to batch.

B. During the course of the work, the batch plant will make quantitative measured moisture determinations of the aggregates utilized in each batch. Aggregate weights and batch water requirements shall be adjusted accordingly for measured aggregate moisture content.

C. When concrete is transported in units approved for mixing, the addition of not more than 10% of the total design water will be permitted at the job site to obtain initial slump.

1. Any addition of water shall be followed by mixing of at least 30 revolutions in the mixing speed range.

2. No more than two additions of water at the point of deposition before discharge shall be allowed.
3. No retempering of the concrete will be permitted. Retempering is defined as the addition of water after the mix has attained its desired initial slump.

2.09 DETECTABLE WARNING SYSTEM

A. Cast in concrete, iron detectable warning plates (cast iron), with raised detectable/tactile domes. Units shall be interlocking or concealed bolted to provide varying lengths, ADA compliant. Standard of quality shall be East Jordan Iron Works, Inc., Cast Iron Detectable Warning Plates, (800) 626-4653, www.ejiw.com or Architect approved equal.

B. Finish: Natural Patina providing visual contrast.

C. Guarantee period shall be five (5) years from substantial completion including defective work, breakage, deformation, heave, and loosening plates.

2.10 HIGH STRENGTH ANCHORING EPOXY SYSTEM

A. A two-component vinylester adhesive anchoring system. The system includes injection adhesive in plastic cartridges, mixing nozzles, dispensing tools and hole cleaning equipment.

B. Designed for bonding threaded rod and reinforcing bar elements into drilled holes in concrete and masonry base materials.

C. Standard of quality shall be AC100+ GOLD Vinylester Injection Adhesive Anchoring System as distributed by A.H. Harris, (315) 414-0340, or Architect approved equal.

2.11 RETAINING WALL(S) FORM LINER

A. Form Liner: Shall be a deep relief form liner comprised of SPS Plastic Polystyrene to achieve sawn wood pattern out of concrete. The standard of quality shall be as manufactured by Symons Forming Systems, Dayton Superior 800-800-7966 www.daytonsuperior.com or Architect approved equal.

B. Pattern approved by Architect

1. Pattern: 4-Inch Variable Depth Rough Cedar
2. Relief: 1/2" max.
3. Form Size: 4' x 10'
4. Product Code: F947007
5. Color stain: None (natural grey concrete color finish)

2.12 CONCRETE BONDING AGENT

A. Shall be a concrete bonding adhesive specifically formulated for permanently bonding new concrete to old concrete in exterior applications.

B. Concrete bonding adhesive applied to appropriate substrates will achieve tensile bond strengths typical of 150 psi in 28 days.

C. Standard of quality shall be Quickrete Concrete Bonding Adhesive or Architect approved equal.

PART 3 - EXECUTION

3.1 CONCRETE WALKS, PADS, AND RAMPS

A. Surface Preparation: Remove loose material from the compacted subgrade surface immediately before placing concrete. Remove any standing water, mud, debris, frost, snow, ice from surfaces upon or against which concrete is to be placed.

B. Proof-roll prepared subgrade surface to check for unstable areas and the need for additional compaction. Do not begin concrete pour until such conditions have been corrected, subgrade is compacted to 95% and ready to receive concrete.

C. Form Construction: Construct to required size and shape. Brace and secure to maintain alignment, elevation and position. Check completed formwork for grade and alignment, prior to installing concrete. Clean forms as needed to removed foreign matter.

D. Install welded wire mesh on concrete brick or mesh chairs to proper level in maximum lengths possible. Offset end laps in both directions. Splice laps with tie wire. Lifting mesh after concrete pouring is not acceptable.

E. Prepare concrete mixture including the following:

1. Add hot weather or cold weather admixture to accommodate field weather conditions.

F. Concrete Testing: Will be performed as described in Part 3, "Field Quality Control" of this specification section.

G. Conveying:

1. Convey concrete by means that will prevent segregation and loss of mortar form the mix.
2. Provide adequate manpower and equipment in the form of buckets, buggies, chutes, conveyors or other approved means to assure continuous operation.
3. Convey concrete so that no equipment with aluminum parts comes in contact with fresh concrete.

H. Concrete Placement: Do not place concrete until subgrade and forms have been checked for line and grade. Moisten granular base course as required to provide a uniform dampened condition at the time concrete is placed. Do not place concrete around manholes or other structures until they have been brought to the required finish grade, alignment, and expansion joints have been installed.

I. Spread concrete as soon as it is deposited on the granular base course, using methods which prevent segregation of the mix, and with as little rehandling as possible. Consolidate concrete along the face of forms. Consolidate with care to prevent dislocation of mesh, reinforcing and joint materials.

J. Install Concrete Walk Joints:

1. Construct expansion and contraction joints as detailed and as shown on plans. Concrete joints that do not follow the pattern(s) shown on the plans and/or changes that have been approved by the Architect will be removed and replaced at no additional cost to the Owner.

2. When the walkway is abutting existing walks, place transverse joints to align with previously placed joints, unless otherwise shown.
3. Contraction Joints: Approximately 5' on center. Break walk into individual slabs of not more than twenty-five (25 sf) square feet with jointing tool, round edges. Saw cut scoring pattern (contraction joints) to depth shown on details for each type of concrete work with new, sharp concrete sawblade one day (24 hours) after the pour. Joint cuts to be clean, sharp, uniformly made cuts to achieve scoring pattern as shown and detailed. Note: When tooled joints or saw cutting is not performed as described, an extended three (3 yr.) year written guarantee or credit for defective work will be required as determined by the Architect at no additional cost to the Owner.
4. Expansion Joints: Provide where abutting building(s), columns, structures, concrete paving and curbs, catch basins, manholes, inlets, walks, walls, other fixed objects and as directed by the Architect.
5. Locate expansion joints at thirty feet on center (30' o.c.) for each walkway lane, unless otherwise shown. Provide slip dowels as detailed and specified.
6. Locate expansion joints with slip dowels at all flush building access points, whether specifically shown on drawings or not.
7. Extend joint fillers full width and depth of the joint, flush with finished pavement grade, and not less than 1/4" or more than 1/2" below the finished pavement surface. Joint surfaces shall be clean and dry prior to installation of sealant as per manufacturer's recommendations. Remove excess sealant on surfaces adjacent to joint.

K. Concrete Finishing:

1. Perform concrete finishing using machine or hand methods as required.
2. After striking off and consolidating concrete, smooth the surface by screeding and floating. Use hand methods only where mechanical floating is not possible. Adjust the floating to compact the surface and produce a uniform texture.
3. After floating, test surface for trueness with a ten (10') foot straightedge. Distribute concrete as required to remove surface irregularities, and refloat repaired areas to provide a continuous, smooth finish.
4. Work edges of slabs and joints with a 1/8" radius edging tool, two (2") wide, unless otherwise shown.
5. After completion of floating and when excess moisture or surface sheen has disappeared, complete surface finishing, as follows.
6. Broom finish, by drawing a medium hair broom across the concrete surface as detailed. Repeat operation when required to provide a medium texture acceptable to the Architect.
7. For handicap curb ramps, tool grooves along sloping surfaces in line with drainage flow as detailed.
8. Curing: Refer to schedule noted in 1.6, above.

    a. Immediately after placement, protect concrete form premature drying.
    b. Remove all dirt, dust, oil, grease, asphalt and foreign matter. Cleanse with caustics and detergents as required. Rinse thoroughly and allow to dry.
    c. Stir curing compound thoroughly before using.
    d. Apply a continuous, uniform film by solvent-resistant low pressure spray only, short-nap roller or lamb's wool applicator. For best results, use a canister curing compound sprayer. Use spray tip number 8004 or equivalent for water-based or waterborne products.
    e. For curing, apply first coat evenly and uniformly as soon as possible after final finishing. Apply second coat when all construction is completed and structure is ready for occupancy.

f. When soil contamination occurs, notify the Architect immediately in writing. Remove contaminated soils and legally dispose of, provide soil test(s), replace soil, plantings and lawns at no additional cost to the Owner.

L. Detectable Warning System:

1. Pour and float concrete, set tile by tamping grid pattern down into the concrete until all air voids are removed with a rubber mallet.
2. Place two cinder blocks or 25 lbs weights on the tile to prevent floating.
3. Create an edge around the perimeter of the tile using a 3/8" radius edging tool then float the concrete around the tile's perimeter using a steel trowel.
4. After concrete has cured, remove protective plastic wrap.
5. Protect tiles against damage during construction and clean tiles as recommended by the manufacturer.

3.02 CONCRETE CURB

A. General: Concrete Curb shall meet the requirements specified for concrete in this Section, Item 3.1 above. Install forms true to line and grades given on plan. Provide permanent in place expansion joints using pre-molded expansion joint filler thirty feet (30' o.c.) on center, maximum. Install reinforcing bars as detailed. Remove forms in twenty-four (24) hours. Saw cut the contraction joints approximately 10' on center 1-1/2" deep with a new sharp concrete saw blade the next day after the pour along top and both faces of curb. Note: When the sawcutting is not performed as described, an extended written guarantee or credit for defective work will be required by the Architect.

B. Finishing: Remove ties and patch tie holes, including those below grade. Remove fins and patch minor voids. Chip out major stone pockets and repair. Rub surface smooth with carborundum brick dipped in neat cement grout to fill pin holes. Trowelled on cement plaster is prohibited. After drying, rub off excess cement dust with burlap.

C. Curing: See 3.1, above.

D. Slip-formed (machine formed) gutters and curbs are acceptable when installed in accordance with NYSDOT 609-3.04-B using Type "J" concrete and mixing in fiber mesh as specified. Expansion and contraction joints are still required as detailed including slip dowels at expansion joints.

3.03 CONCRETE STAIRS

A. General: Concrete stairs shall meet the requirements specified for concrete in this Section, Item 3.1, except as noted below.

B. Verify that lines, levels, locations and form dimensions comply with drawings and submittals.

C. Design, erect, support, brace, and maintain formwork to support applied vertical and lateral loads. Construct formwork to provide correct size, alignment, elevation, pitch on tread, and position of concrete work.

D. Design and erect formwork to permit removal without damage to cast-in-place concrete surfaces and adjacent materials during stripping .

E. Install, align, and level forms. Support and brace forms in place.

F. Coat form surfaces with form release agent. Clean forms after each use and coat with form release agent as necessary to assure separation from concrete without damage. Apply before placing reinforcing steel, anchoring devices, and embedded items.

G. Provide reinforcing bars adequately supported and secured to prevent displacement.

H. Placement of concrete shall be in layers not to exceed 18 inches without consolidation with the aid of mechanical vibrating equipment. To achieve even and dense surfaces, free of aggregate pockets or honeycomb, vibration shall be supplemented by spading by hand in the corners and angles of forms and along surface while concrete is plastic under the vibratory action. Placement of concrete shall conform to recommendations of ACI 309 "Recommended Practice for Consolidation of Concrete".

I. Install, set, and build-in items furnished by other trades. Provide adequate notification for installation of necessary items. Coordinate with reinforcing, safety railings and hand railings.

J. Remove ties and patch tie holes, including those below grade. Remove fins and patch minor voids. Chip out major stone pockets and repair. Rub surface smooth with carborundum brick dipped in neat cement grout to fill pin holes. Trowelled on cement plaster is prohibited. After drying, rub off all excess cement dust with burlap.

K. Medium broom finish stair treads with strokes perpendicular to flow of pedestrian traffic, similar to walks. Other exposed concrete surfaces shall be rub finished similar to concrete curb.

L. Cure and seal as specified in this section, item 3.1 above.

M. Strip Forms and Bracing: Three (3) days minimum before stripping. It is the Contractor's responsibility to determine the time at which forms may be removed without damaging the stairs and only after concrete has gained sufficient strength to carry its own weight and imposed loads.

3.04 CONCRETE RETAINING WALL(S)

A. General: Concrete retaining wall(s) shall meet the requirements specified for concrete in this specification section, Item 3.1, except as noted below.

B. Verify that lines, levels, locations and form dimensions comply with drawings and submittals.

C. Design, erect, support, brace, and maintain formwork to support applied vertical and lateral loads. Construct formwork to provide correct size, alignment, elevation, pitch on tread, and position of concrete work.

D. Design and erect formwork to permit removal without damage to cast-in-place concrete surfaces and adjacent materials during stripping . Thoroughly clean forms and adjacent surfaces to receive concrete. Remove sawdust, dirt or other debris before placing concrete. Tighten forms and bracing to prevent mortar leaks and maintain proper alignment.

E. Install, align, and level forms. Support and brace forms in place. Provide watertight joints, sealed to prevent leakage. Rustication strips are recommended at construction joints or between pours. Chamfer exposed corner and edges as detailed, using wood, metal PVC or rubber chamfer strips fabricated to provide uniform smooth lines and tight edge joints.

F. Form Liners: Shall be placed adjacent with less than ¼" seam; securely attach liner to forms per manufacturer's recommendations; continue wall ties with liner and from manufacturer. Liner shall be cleaned of all prior concrete build up prior to each pour shall be inspected for blemished and/or tears; repair if necessary per manufacturer's recommendation. Form release shall then be applied per manufacturer's recommendation.

G. Provide reinforcing bars adequately supported and secured to prevent displacement. Splices in reinforcing bars shall conform to ACI 318 and stagger splices wherever possible.

H. Seams: Liner butt joints shall be carefully blended into the approved pattern. No visible vertical or horizontal seams or conspicuous marks created by butt jointing form liners will be allowed. Work to conform to approved sample.

I. Placement of concrete shall be in layers not to exceed 18 inches without consolidation with the aid of mechanical vibrating equipment. To achieve even and dense surfaces, free of aggregate pockets or honeycomb, vibration shall be supplemented by spading by hand in the corners and angles of forms and along surface while concrete is plastic under the vibratory action. Placement of concrete shall conform to recommendations of ACI 309 "Recommended Practice for Consolidation of Concrete".

J. Install, set, and build-in items furnished by other trades. Provide adequate notification for installation of necessary items. Coordinate with reinforcing, safety railings and hand railings.

K. Strip Forms and Bracing: Stripping form liners shall be done within three (3) days. It is the Contractor's responsibility to determine the time at which forms may be removed without damaging the walls or weakness to the substrate and only after concrete has gained sufficient strength to carry its own weight and imposed loads.

L. Install drainage behind wall and retaining wall granular backfill to 95% compaction behind wall as detailed and specified in Section 312201.

M. Patches: Fill tie holes and defects in concrete surface within 48 hours of form removal. Use the same patching materials and techniques that were approved on mockup. Make patches with a still mortar made with materials from the same sources as the concrete. Adjust mortar mix if necessary to lighten it.

N. Rough-Formed Finish: Provide a rough-formed finish on formed concrete surfaces NOT exposed to view in the finish work or concealed by other construction.

O. Smooth-Formed Finish: Provide a smooth-formed finish on formed concrete surfaces to view or to be covered with a coating or covering material applied directly to the concrete, such as waterproofing, veneers or painting. Repair and patch defective areas with fins and other projections.

P. Rubbed-Finish:

1. Smooth-Rubbed Finish: Not later than one day after form removal, moisten concrete surfaces and rub with carborundum brick or another abrasive until producing a uniform color and texture. Do not apply cement grout other than that created by the rubbing process.
2. Grout-Cleaned Finish: Wet concrete surfaces and apply grout of a consistency of thick paint to coat surfaces and fill small holes. Mix one part Portland cement

to one and one-half parts fine sand with a 1:1 mixture of bonding admixture and water. Add white Portland cement in amounts determined by trial patches so color of dry grout will match adjacent surfaces. Scrub grout into voids and remove excess grout. When grout whitens, rub surface with clean burlap and keep surface damp by fog spray for at least 26 hours.

Q. The surface shall be sealed with the approved sealer, per manufacturers instructions, if first approved by the Owner

3.05 FOOTINGS, BASES, FOUNDATIONS, SADDLES, CRADLES, COLLARS, AND THRUST BLOCKS

A. Footings, Bases, Foundations: Locate and provide where shown on drawings and as detailed.

B. Saddles: Locate and provide where shown on drawings or where vertical distance between crossing pipes is eighteen (18") inches or less. Construct saddles springline (centerline) to springline and full width of trenches.

C. Cradles: Locate and provide where shown on drawings. Construct cradles the full width of the trench, six (6") inches below the pipe and on both sides of the pipe up to the springline.

D. Collars: Locate and provide where shown on drawings or where pipe slopes exceed ten (10%) percent. Construct collars one (1') foot thick, full width of trench plus one (1') foot extension each side, above and below pipe.

E. Thrust Blocks: Locate and provide where shown on drawings. Also for sanitary force main and water pipes at (1) connections to existing systems, (2) at changes in horizontal alignment of 22-1/2 degrees or more, and (3) at tees, crosses, valves, hydrants and plug (end of pipe) conditions. Block and anchor with concrete so that there will be no movement of the pipe in the joints due to internal or external pressures. The concrete shall be placed around the fittings and completely fill the space between the fittings and walls of the trench, from 6" below the fittings of pipe, to 12" above the fittings. The anchor concrete shall be so placed that the bell and spigot joints or other joints may be recaulked or tightened if necessary. Concrete thrust blocks shall conform dimensionally to details shown on drawings.

3.06 INTERRUPTION OF CONCRETING

A. Should placing concrete be suspended or unavoidably interrupted, provide key ways and bulkheads to prevent feather-edging when work is resumed. Roughen horizontal surface for bond.

B. Incorporate bulkheads with proposed vertical expansion joints or control joints and space as shown on the drawings or in a layout acceptable to the Architect.

3.07 REPAIR AND PROTECTION FOR CONCRETE WORK

A. Cut out and replace defective concrete work which has blisters, cracking, crazing, curling, discoloration, dusting, efflorescence, low spots, pop outs, scaling or mortar flaking, spalling, settling, or heaving as defined by Portland Cement Association 2001, "Concrete Slab Surface Defects" and as directed by the Architect.

B. Modify or replace concrete not conforming to the required lines, details, elevations and specifications as directed by the Architect.

C. Protect the work from damage until acceptance of the work. Exclude traffic from concrete work for at least fourteen (14) days after placement. When construction traffic is permitted, maintain concrete as clean as possible by removing surface stains and spillage of materials as they occur.

D. Let the cement harden for at least 60 minutes. For heavy equipment, allow 4 hours prior to use or loading.

3.08 ANCHORING BOLTS, DOWELS, AND REBAR INTO CONCRETE

A. Anchor Hole Preparation: Prepare all anchor holes prior to placement of anchoring epoxy. Hole diameter is typically 1/8" (3 mm) greater than the anchor diameter. Hole depth is typically nine times anchor diameter. Required minimum anchor hole depth is 6". Consult project specifications and details. Drill hole to proper diameter and depth and blow all dust from the bottom of the hole, brush and blow (4x) repeatedly to remove all dust and debris. The anchor hole must be clean and free of standing water prior to placement of material.

B. Application: Use only professional caulking gun. Remove plastic cap and plugs from cartridge. Save for closing cartridge. Attach mixing nozzle to cartridge. Discard small amount of gunned product until uniform color is achieved. Mixing nozzle will harden in approximately 20 min. if not in use.

C. Hardened nozzle must be discarded. Dispense the epoxy at the bottom of the hole while withdrawing nozzle. Dispense epoxy (typically filling 5/8 of hole) so that once threaded rod or rebar is inserted, the hole is completely full. Insert threaded rod or rebar to the bottom of the hole while turning clockwise. Promptly remove any excess material. Leave anchor undisturbed for 6 hours (at 77°F /25°C), or longer for colder temperatures. Load can be applied 8 hours at 77°F (25°C).

3.09 CONCRETE BONDING AGENT

A. Required at elements where new concrete is applied and joined to existing concrete.

B. Surface Preparation:

1. Apply only to clean, sound, dry surfaces.
2. Remove dust, dirt, oil, grease, wax, unsound concrete and plaster, paint, and other foreign materials.

C. Applications:

1. Apply to a dry surface with brush, roller or spray to the thickness of a coat of paint.
2. Place new concrete, topping mixes, Portland cement, or patches as soon as the adhesive is dry.
3. Make sure basecoat is dry before applying adhesive.
4. Tools, brushes and other application accessories should be immediately cleaned with soapy water. Use hot water to clean up any drippings.

3.10 FIELD QUALITY CONTROL

A. Field inspection and testing shall be performed by ACI certified technicians; Grade 1. Certificates shall be submitted to the Architect for persons performing inspection and testing prior to the start of work.

B. Field Inspection and testing shall be paid for as directed under 1.5 "Quality Assurance". Where retesting, additional inspection, lab tests or other professional services are required due to rejected work, any cost associated therewith will be solely at the Contractor's expense.

C. The Contractor shall plan his operations to allow adequate time for all required testing and inspection.

D. The Contractor shall provide facilities and equipment necessary to obtain and handle representative sample of materials to be tested.

E. The testing laboratory shall be responsible to the Owner for the field control of all concrete and may reject batches because of high slump, uncontrolled air entrainment, delays or other conditions of non-compliance with these specifications.

F. Sampling and Field testing will be performed during concrete placement per ASTM C31, C39, C143, C172 and C173.

G. Five (5) Concrete Test Cylinders: Taken for every 30 or less cubic yards of concrete placed are required or a fraction thereof;

1. Two (2) Cylinders will be tested at 7 days, two (2) cylinders will be tested at 28 days and one (1) cylinder will be held for possible testing at a later time.

H. One (1) Additional Test Cylinder: Taken during cold weather concreting, to be cured on the job site under the same conditions as placed concrete it represents, is required.

I. Air Content Test: Taken for each set of test cylinders taken, is required.

H. One (1) Slump Test: Taken for each set of test cylinders taken is required.

K. Test results will be reported by telephone to the General Contractor and Architect on same day tests are made. Written report with copies will follow to the Owner, Architect, and Landscape Architect. Email copies of laboratory test, evaluation reports for concrete materials and mix designs will be submitted.

3.11 CLEAN UP

During the contract and at intervals as directed by the Architect and as concrete work is completed, clear the site of gravel, concrete, appurtenances and debris. Remove temporary concrete washout facilities. Leave the site in a clean, safe, well draining, neat condition.

END OF SECTION 32 13 01

SECTION 32 30 01
TEMPORARY CONSTRUCTION FENCE AND GATES

PART 1 - GENERAL

1.01 DESCRIPTION OF WORK

A. The extent of temporary fence and gates or construction barriers is shown on the drawings. Provide freestanding or fixed fence types as required or directed by CM.

B. Provide materials, labor, equipment and services required to accomplish related work in accordance with the drawings and specifications.

C. Temporary fencing/ construction barriers may be relocated or repositioned throughout the construction period as directed by the CM and/or Owner.

1.02 RELATED WORK SPECIFIED ELSEWHERE

A. Section 011100 – Summary of Work
B. Section 015000 – Temporary Facilities and Controls

1.03 JOB CONDITIONS

A. Job conditions in Section 311201 apply.

PART 2 - PRODUCTS

2.01 CHAIN LINK FENCE AND GATES (TEMPORARY)

A. Shall be new or good quality used Chain link, 6-foot height.
or
B. Freestanding Interlocking Chain Link Panels: Shall be galvanized 6-foot height 10-foot panels with 1½" diameter tube frame welded construction with ground stantions.

C. Chain link fence with concrete footings for fixed gate posts.

D. Sandbags for fence ballast.

2.02 PLASTIC FENCE (FOR TEMPORARY VEHICULAR AND PEDESTRIAN CONTROL)

A. Shall be new or good quality used 4’-0” high heavy-duty orange plastic fence NC450. Post shall be new or good quality U-channel posts.

B. Locate as required for safety, vehicle and pedestrian control, or as directed by the Architect/ CM.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Walk the site with the Architect and/or CM to determine locations of construction fence, barriers and gates.

B. Erect posts plumb. Drive posts into firm ground with driving caps to avoid deforming posts.

C. Install traffic barriers as directed by the Architect. Provide temporary waring devices, traffic control signage or pedestrian wayfinding as directed.

D. Remove temporary fences and barriers at completion of project. Repair ground surface as directed by the Architect.

3.02 CLEAN UP

During the contract and at intervals as directed by the Architect and as construction fence and gate installation is completed, clear the site of extraneous site materials. Leave the site in a clean, safe, well-draining, neat condition.

END OF SECTION 32 30 01

SECTION 32 30 02
METAL BOLLARDS

PART 1 - GENERAL

1.01 DESCRIPTION OF WORK

A. The extent of metal bollards is shown on the drawings and as specified in the contract documents.

B. Metal bollards work includes, but is not limited to, the following:

1. Providing and installing metal bollards as noted in the specifications and as detailed.

2. Provide bollard slip covers.

3. Cleanup.

C. Provide all labor, materials, tools, equipment, and services required to install metal bollards and furnishings as indicated on the plans and as specified.

D. The installation of all new materials shall be performed in strict accordance with the manufacturer's installation instruction and in accordance with all approved shop drawings and submittals.

1.02 RELATED WORK SPECIFIED ELSEWHERE

A. Section 321301 - Site Concrete Work
B. Section 323004 - Traffic Signs

1.03 REFERENCES

A. Manufacturers Data and Recommended Installation Requirements

1.04 SUBMITTALS: (See Section 31 12 01, 1.05)

A. Provide Manufacturer's Product Data (MPD), Material Certificate and samples as noted:

1. Bollard Cover (¼" nominal wall thickness polyethylene thermoplastic): MPD
2. Bollard Cover color chart (color approved by Architect).
3. Schedule 40 Steel Pipe.
4. Reflective Tape: MPD and Sample

1.05 JOB CONDITIONS

A. Job conditions in Section 31 22 01 apply.

B. Construction Review: Notify the Architect when footing location(s) for metal bollards are coordinated to avoid underground utilities and marked in the field.

1.06 QUALITY ASSURANCE

A. Manufacturer's warranties shall pass to the Owner and certification made that the product materials meet all applicable grade trademarks or conform to industry standards and inspection requirements.

B. Ten (10) year warranty against fading.

1.07 DELIVERY, STORAGE, AND PROTECTION

A. Deliver products to project site in wrapped, neat, secure condition. Provide means to unload products from delivery trucks.

B. Protect all products and installation area from vandalism, theft, other construction, premature use, etc. until Owner acceptance and Architect sign off.

C. Materials delivered to the site shall be examined for damage or defects in shipping. Any defects shall be noted and reported to the Owners representative. Replacements, if necessary, shall be immediately reordered, to minimize any conflict with the construction schedule. Sound materials shall be stored above ground under protective cover or indoors to provide proper protection.

PART 2 - PRODUCTS

2.01 METAL BOLLARD

A. Pipe: Shall be galvanized schedule 40 steel pipe, **6-inch** OD x ½" wall thickness.

B. Concrete: Shall be 4000 psi as specified in Section 32 13 01.

2.02 REFLECTIVE TAPE

Shall be exterior grade, reflective. Standard of quality shall be Scotchgard, as manufactured by 3M or Architect approved equal. Color as noted on detail.

2.03 BOLLARD COVER

Shall be made of ¼" nominal wall thickness polyethylene thermoplastic (LDPE). Top shall be domed. Standard of quality shall be as manufactured by Ideal Shield or Architect approved equal. Color shall be selected by Owner and approved by Architect from standard manufacturer's color options.

2.04 TRAFFIC SIGNS (Refer to Section 323004)

PART 3 - EXECUTION

3.01 INSTALL METAL BOLLARD

A. Shop cut bollard.

B. Locate per plan and install as detailed. Verify location of underground utilities. Neatly saw cut pavement or install bollards before paving.

C. Auger hole for concrete footing. Set metal bollard in center of hole and brace plumb and vertical.

D. Fill annular spaces around and inside metal bollard with concrete. Dome top of concrete footing and concrete inside metal bollard to shed water. Check for alignment and set plumb.

E. When concrete has set, remove braces.

F. Install bollard cover and reflective tape per manufacturer's recommendations. Anchor cover to bollard with a single set screw at bottom of post.

G. Install traffic post and mount sign plates as detailed for locations designated as reserved parking.

H. Protect bollards until accepted.

3.02 CLEAN UP

During the contract and at intervals as required by the contract documents and as directed by the Architect and as metal bollards are installed, clear the site of all extraneous materials, rubbish, and debris. Leave the site in a clean, safe, well-draining, neat condition.

END OF SECTION 32 30 02

SECTION 32 30 03
ALUMINUM HAND RAILS & SAFTEY RAILINGS

PART 1 - GENERAL

1.01 DESCRIPTION OF WORK

A. The extent of aluminum hand railing and railings is shown on the drawings including:
1. Hand railings at ramp.
2. Safety fence mounted to site retaining walls.
3. Hand railings at steps.

B. Provide all materials, labor, equipment, and services required to accomplish all related work in accordance with the drawings and specifications.

1.02 RELATED WORK SPECIFIED ELSEWHERE

A. Section 321301 - Site Concrete Work

1.03 SUBMITTALS

A. Shop Drawings, Samples, and Manufacturer's Data: Provide five copies stamped and approved by the Contractor before submittal to the Architect. Submit to the Architect for review a minimum of two weeks before delivery to site.

B. Required submittals are:

1. Aluminum Hand Railing and Railings: Shop Drawings include plans, elevations, sections, details, and attachments to other work. and detailing.
2. Finish Selection: Provide sections of railing or flat sheet metal which depict available mechanical surface finishes.
3. Sample: 6 inch long sections of each different linear railing member, including handrails and top rails.
4. Mock-up not required.

1.04 JOB CONDITIONS

A. All job conditions in Section 312201 apply.

B. Construction Review: Notify the Architect when aluminum hand railing is delivered to the site. Verify existing conditions with approved shop drawings.

C. Materials and methods of construction shall comply with the following standards:

1. Aluminum Association, Inc. (AA): 1. AA SAS-30, "Specifications for Aluminum Structures."
2. American Architectural Manufacturers Association (AAMA):
a. AAMA 611, "Voluntary Specifications for Anodized Architectural Aluminum (Revised)."
b. AAMA 2604, "Voluntary Specification, Performance Requirements, and Test Procedures for High Performance Organic Coatings on Aluminum Extrusions and Panels." Aluminum Handrails and Railings 05 52 00 - 2 08/17/16 3. AAMA 2605, "Voluntary Specification, Performance Requirements, and Test Procedures for Superior Performing Organic Coatings on Aluminum Extrusions and Panels."

3. American Welding Society (AWS):
a. AWS D1.2, "Structural Welding Code – Aluminum."

4. ASTM International (ASTM):
   a. ASTM B26/B26M,"Standard Specification for Aluminum-Alloy Sand Castings."
   b. ASTM B209/B209M,"Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate."
   c. ASTM B210/B210M, "Standard Specification for Aluminum and Aluminum-Alloy Drawn Seamless Tubes."
   d. ASTM B221/B221M, "Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes."
   e. ASTM B247/B247M, "Standard Specification for Aluminum and Aluminum-Alloy Die Forgings, Hand Forgings, and Rolled Ring Forgings."
   f. ASTM B429/B429M, "Standard Specification for Aluminum-Alloy Extruded Structural Pipe and Tube."
   g. ASTM E488, "Standard Test Methods for Strength of Anchors in Concrete and Masonry Elements."

PART 2 - PRODUCTS

2.01 ALUMINUM HAND RAILS or RAILINGS

A. Railings and Posts: Aluminum extrusions; alloy and temper 6063-T4. 1. Pipe: ASTM B 429.

B. Extruded Aluminum Components: Provide manufacturer's standard extruded aluminum components as follows:

   a. Standard Post: 2" dia. (OD) with radiused corner x 0.125" wall thickness.

   b. Rails: : 2" dia. (OD) x 0.125" wall thickness.

   c. Base Plate/ flange: 6"x6" x 5/16" thickness, ASTM B209, ASTM B247, alloy 6061-T6

C. Finish: Anodized, Satin Brushed (machine brushed finish - no maintenance, no scratched color finish)

D. Anchoring: Surface mount with stainless steel fasteners. Fabricate anchorage devices capable of withstanding loads imposed by handrails and railings. Coordinate anchorage devices with supporting structure. ASTM F1554 Grade 36

E. Wall mounted: Aluminum wall brackets, matching finish of railings and stainless steel expansion anchor bolts.

F. Provide manufacturer's standard wall brackets, flanges, miscellaneous fittings, and anchors to connect handrail and railing members to other construction.

2.02 FINISH OPTION

A. Contractor has the option to provide powder coated painted finish on site aluminum handrails, railings and safety railings. Color to be approved by Owner/ Architect.

PART 3 - EXECUTION

3.01 FABRICATION

A. Take field measurements and coordinate work with others.

B. Shop fabricate in accordance with field measurements, favorably reviewed shop drawings and standards referenced above in Job Conditions. Fabricate, preassemble in shop to greatest extent possible to minimize field fitting and assembly.

C. Fabricate handrails and railings by connecting members with railing manufacturer's standard concealed mechanical fasteners and fittings, unless otherwise indicated. Fabricate members and fittings to produce flush, smooth, rigid, hairline joints.

D. Provide manufacturer's standard wall brackets, flanges, miscellaneous fittings, sleeves and anchors to connect handrail and railing members to other construction.

E. Provide metal fabrications work square, plumb, straight and true to shop drawing dimensions.

F. Bend or form pipe to continuous and true curves, with joints neatly welded and assembled.

G. Provide for anchorage of type required, coordinated with supporting structure. Fabricate and space anchoring devices to provide adequate support for intended use.

H. Close exposed ends of railing members with prefabricated end fittings.

I. Provide mounted handrail wall returns at wall ends unless otherwise indicated. Close ends of returns, unless clearance between end of railing and wall is 1/4 inch (6 mm) or less.

J. Allow for material expansion when handrails are over 30 feet in length with concealed pipe sleeves.

3.02 FIELD INSTALLATION

A. Do not install handrail posts until concrete has attained its full design strength (approximately 28 days).

B. Transport safely and install upon delivery, (no on-site storage available).

C. Verify existing conditions.

D. Corrosion Protection: Provide separation as recommended by manufacturer on concealed surfaces of aluminum that will be in contact with grout, concrete, masonry, wood, or dissimilar metals.

E. Adjusting: Adjust handrails and railings before anchoring to ensure alignment at abutting joint's space posts at interval indicated, but not less than required to achieve structural loads.

F. Fastening to In-Place Construction, (surface mounted): Use anchorage devices and fasteners where necessary for securing handrails and railings and for properly transferring loads to in-place construction.

G. Embedment Construction, (concrete footers): Embed railing posts in wet concrete, plumb and brace securely. Top of concrete to be set below finish grade. Maintain a minimum of 2” clearance to allow asphalt top-course.

H. Seal gaps between mounting plate and surface with caulk.

3.03 ADJUSTING AND CLEANING

A. Immediately after erection, clean field welds, bolted connections, and abraded areas of finish, and appoint exposed areas to approved finish.

B. Cleaning: Restore finishes damaged during installation and construction period so no evidence remains of correction work. Replace materials as directed by the Architect that remain unsatisfactory in finish or construction.

3.04 PROTECTION

A. Provide final protection and maintain conditions in a manner acceptable to the Installer, that shall ensure that the aluminum handrails and railings shall be without damage at time of Substantial Completion.

B. Protect finishes of handrails and railings from damage during construction period with temporary protective coverings approved by railing manufacturer. Remove protective coverings at the time of Substantial Completion.

3.05 CLEAN UP

A. During the contract and at intervals as directed by the Architect and as aluminum hand railing installation is completed, clear the site of all extraneous concrete, gravel, asphalt or debris. Leave the site in a clean, safe, well draining, neat condition.

END OF SECTION 32 30 03

SECTION 32 30 04
TRAFFIC SIGNS

PART 1 - GENERAL

1.01 DESCRIPTION OF WORK

A. The extent of new traffic signs is shown on the drawings.

B. Provide materials, labor, equipment, and services required to accomplish related work in accordance with the drawings and specifications.

C. Remove, salvage and relocate existing traffic signs that interfere with work operations. Salvaged sign plates that are in good condition may be reused.

D. Replace sign posts that are damaged when reinstalling existing signs.

1.02 SUBMITTALS: (Provide Section 311201, 1.5)

A. Provide shop drawings for each different type and size of sign listed in the Traffic Sign Schedule.

B. Provide MPD for sign posts and plates.

1.03 JOB CONDITIONS

A. Job conditions in Section 312201 apply.

B. No work shall be fabricated until shop drawings for the work have been favorably reviewed by the Architect.

C. Construction Review: Notify the Architect when locations for signs are coordinated to avoid underground utilities and marked in the field for review.

D. Provide sleeves, anchors, footings and other items and build in coordination with work of other trades.

1.04 RELATED WORK ELSEWHERE

A. Section 321301 – Site Concrete
B. Section 323002 – Metal Bollards

PART 2 - PRODUCTS

2.01 SIGNS

A. Sign Plate:

1. Sign Plate shall be aluminum sheets .090" (approximately 3/32") thick, with two coats of Dupont Imron spray semigloss paint.

2. Letters, numbers, symbols, and arrows shall be engineering grade, (EG) reflective. Sign plates, letters and numbers shall meet the colors and regulations described in the "Manual of Uniform Traffic Control Devices", latest edition, as

published by the State of New York Department of Transportation, Division of Traffic and Safety.

3. Refer to Traffic Sign Schedule and/or sign details on drawings for sign wording, quantities, and other information.

4. Hardware shall be galvanized.

5. Standard of quality shall be as manufactured by Eastern Metal/USA-Sign, www.usa-sign.com or Architect approved equal.

B. Sign Posts: Shall be high carbon new billet steel (Grade SP-80) "Rib-Bak" U-channel posts with predrilled 3/8" holes at 1" on center. Posts shall be 2.75 lbs./ft. with hot dipped galvanized. Color as directed by the Architect. Standard of quality shall be as manufactured by NUCOR Steel Marion, Inc., (800) 333-4011 or Architect approved equal.

2.02 CONCRETE FOR FOOTINGS: As specified in Section 321301, 2.1.

PART 3 - EXECUTION

3.01 INSTALL SIGNS

A. Erect signs plumb. Drive posts into firm ground or bolt to sleeve in pavement areas or concrete footings as detailed. Use driving caps to avoid deforming posts.

B. Mount sign plates at heights detailed. Attach metal sign plates to steel posts securely with 1/4" galvanized nuts and bolts.

C. Re-install salvaged signs that are in good condition in locations as shown on the plans or as directed by the Architect. Replace sign posts with new as directed by the Architect.

D. Traffic Signs that are temporarily removed or relocated within the Right-of-Way shall be re-installed in accordance with the Manual on Uniform Traffic Control Devices (MUTCD), latest edition.

E. Provide bollard mounted signs as detailed and shown on the drawings.

3.02 CLEAN UP

During the contract and at intervals as directed by the Architect and as traffic sign installation(s) are completed, clear the site of extraneous paint, fasteners, concrete, gravel, asphalt and debris. Leave the site in a clean, safe, well draining, neat condition.

END OF SECTION 323004

SECTION 32 30 05
SITE FURNISHINGS

PART 1 - GENERAL

1.01 DESCRIPTION OF WORK

A. The extent of site furnishings is shown on the drawings. Site furnishings include:

1. Precast Concrete Bench (6 total) forming a circle pattern.

B. Provide materials, labor, equipment, and services required to accomplish related work in accordance with the drawings and specifications.

1.02 SUBMITTALS: (See Section 311201, 1.5)

A. Provide Manufacturer's Product Data (MPD)
B. Provide instructions for handling and installation
C. Provide sample warranty document

1.03 JOB CONDITIONS

A. Job conditions in Section 321301 apply.

B. Construction Review: Notify the Architect when site furnishing locations are marked in the field. Obtain approval before anchoring is installed.

PART 2 - PRODUCTS

2.01 CONCRETE BENCH

A. Reinforced cast stone, free-standing modular unit, TWIG outdoor backless bench, (76” x 93” x 18” seating height, (weight 3,850 lds).
B. Finish: Pearl acid etched.
C. 5-year product warrantee.

D. Standard of quality shall be Model G-01 **TWIG** modular bench system, by Landscape Forms, Inc. 7800 E. Michigan Ave, Kalamazoo, MI 49048.
(P) 800-521-2546 (F) 269-381-3455 landscapeforms.com

PART 3 - EXECUTION

3.01 INSTALL SITE FURNISHINGS

A. Orient benches as shown on drawings. Install as detailed per Manufacturer's instructions.

B. Install concrete bench over asphalt sidewalk material as detailed. Remove interior asphalt after setting the benches and prior to placing planting soil. Allow 14-day cure for asphalt before installing benches to avoid settlement.

C. Set site furnishings vertical and plumb. Provide shims to eliminate rocking. Butt bench ends tight and even.

D. Infill the bench circle encloser with planting soil. Provide filter fabric over butt joints to prevent soil loss. Provide 6-inch reveal on upper finish grade.

3.02 CLEAN UP

During the contract and at intervals as directed by the Architect and as installation is completed, clear the site of extraneous packaging materials, concrete, gravel, asphalt and debris. Leave the site in a clean, safe, well draining, neat condition.

END OF SECTION 32 30 05

SECTION 32 30 06
FLAGPOLE

PART 1 - GENERAL

1.01 DESCRIPTION OF WORK

A. Provide three (3) New flagpoles as shown on the drawings and detailed.

B. Electrical Contract provides power service and connection to flagpoles for integrated pole lighting.

C. Remove and salvage 3 existing flag poles and return to Owner.

D. Provide materials, labor, equipment and services required to accomplish related work in accordance with the drawings and specifications. Coordinate site work with Electrical Contractor.

1.02 RELATED WORK SPECIFIED ELSEWHERE

A. Section 32 13 01 - Site Concrete Work

B. Section 26 60 10 – General Electrical Provisions

1.03 SUBMITTALS: (See Section 31 12 01, 1.05)

A. Provide Manufacturer's Product Data (MPD):

1. Flagpole with lighting and Accessories

1.04 JOB CONDITIONS

A. Job conditions in Section 31 22 01 apply.

B. Construction Review: Notify the Architect when flagpole footing location is coordinated to avoid underground utilities and marked in the field.

PART 2 - PRODUCTS

2.01 FLAGPOLE AND ACCESSORIES (Provide 3)

A. Independence Flagpole: One piece, cone tapered aluminum flagpole, conforming to NAAMM Metal Flagpole Manual.

1. Type: Ground Sleeve Mount
2. Nominal Height: 30’-0”
3. Butt Diameters include: 8"
4. Wall Thickness: 0.188"

B. Aluminum ASTM B221.

1. Finish: Anodized (Standard color options, approved by Architect)

C. Foundation Base: Ground Sleeve Mount: Galvanized 16-Gauge Corrugated Steel Ground Sleeve with Steel Grounding Spike.

D. Flash Collar/Base: High Profile flash collar to accommodate shoe base mount.

E. Internal Halyard Rope Based System: with cam cleat and locking raised access door.

1. Provide manually operated winch.
2. Provide removeable winch handle.
3. Provide a retainer ring

F. Provide 90-watt, 9500 lumens at 5000 K up-light to illuminate the flag. Provide fixture with aluminum housing which clamps and mounts to aluminum flagpole. Fixture rated IP65, nominal size of 14" W x 12.5" H which fits up to 9" pole. Provide access opening with rubber grommet and seal watertight to route cabling down pole to remote driver at pole base. Mount remote driver in NEMA 4 enclosure and secure at pole base. Provide access opening with rubber grommet to extend wiring out of pole to connect to the driver. Provide supports and guides to route electrical cabling within the pole coordinated with all flag cables to avoid interference. Mount fixture at center height of flagpole, verify with Architect. Provide integral photocell control for light. Light product is manufactured by POLELED.

G. Flags: Owner supplied.

H. Standard of quality shall be Independence as manufactured by Eagle Mountain Flag, P.O. Box 500, Wimberly, TX 78676, www.emflag.com or Architect approved equal.

2.02 CONCRETE FOOTING: Shall be 4000 psi as specified in Section 32 13 01.

PART 3 - EXECUTION

3.01 INSTALL FLAGPOLE

A. Locate as shown on drawings. Coordinate footing location to avoid utilities. Install per manufacturer's recommendations. Coordinate with Electrical Contractor for connections.

B. Set pole vertical and plumb. Brace securely.

C. Protect flagpole installation from movement and loading until the concrete footing has attained its full design strength (approximately 28 days). Properly ground the pole as recommended by the manufacturer.

D. Sand smooth and touch paint scrapes and scratches with compatible matching paint. Protect adjacent surfaces. Clean thoroughly when drips or spills occur.

E. Install ball, truck, halyards and other flagpole accessories securely. Provide flag.

F. Verify electrical circuit with adjacent lighting. Flagpole shall be on the same timer as site lighting. Make electrical connections as recommended, meeting local code requirements.

G. Install flag(s) and demonstrate the working requirements to Owner representative. Turn over all necessary tools, keys, product manual and warrantee information to Owner as part of close-out procedures.

3.02 CLEAN UP

During the contract and at intervals as directed by the Architect and as flagpole installation is completed, clear the site of gravel, concrete, appurtenances and debris. Leave the site in a clean, safe, well draining, neat condition.

END OF SECTION 32 30 06

SECTION 32 30 07

PANEL BOX BASE MOUNTED SIGNAGE

PART 1 –GENERAL

1.01 SUMMARY

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

B. This Section includes the following:

1. Provide internally illuminated panel box base mounted sign types.

   a. Single Sided – Building Identification Sign

   b. Reinstall salvaged Camus Map Sign

2. Make final electrical connection to power sign.

C. Related Sections

1.	Section 26 00 10	General Electrical Requirements
2.	Section 32 13 01	Site Concrete
3.	Section 04 20 00	Unit Masonry

1.02 PERFORMANCE REQUIREMENTS

A. Structural Performance: Provide pylon signs capable of withstanding the effects of gravity loads and the following loads and stresses within limits and under conditions indicated:

B. Wind Loads: Determine loads based on the following minimum design wind pressures:

C. Uniform pressure of 100 mph.

D. Uniform pressure as indicated on Drawings.

E. Thermal Movements: Provide multi panel base mounted signs that allow for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures by preventing buckling, opening of joints, overstressing of components, failure of connections, and other detrimental effects. Base engineering calculation on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.

F. Temperature Change (Range): 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.

1.03 DEFINITIONS

A. ADA-ABA Accessibility Guidelines: U.S. Architectural & Transportation Barriers Compliance Board's "Americans with Disabilities Act (ADA) Accessibility Guidelines for Buildings and Facilities; Architectural Barriers Act (ABA) Accessibility Guidelines."

1.04 SUBMITTALS

B. Product Data: Match existing campus sign standard.

C. Shop Drawings: Show fabrication and installation details for pylon mounted to base.

1. Include plans, elevations, sections, details, and attachments to other work.

a. Furnish template for anchor locations.

2. Provide message list, typestyles, graphic elements, and layout for each sign at scale and full-size details of graphics.

3. Include full-size templates for cutout characters and graphic symbols. (Owner shall supply artwork).

4. Show locations of electrical service connections.

5. For installed products indicated to comply with design loads, include structural analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

D. Samples for Initial Selection: Manufacturer's color charts consisting of actual units or sections of units showing the full range of colors available for the following:

1. Aluminum framing.

2. Fiberglass sheet.

E. Samples for Verification: For each of the following products and for the full range of color, texture, and sign material indicated, of sizes indicated:

1. Aluminum: For each form, finish, and color, on 6-inch- (150-mm-) long sections of extrusions and squares of sheet at least 4 by 4 inches (100 by 100 mm).

2. Fiberglass Sheet: 8 by 10 inches (200 by 250 mm) for each color required.

3. Include a full-size representative sample of required in each panel. Show graphic style, colors, finishes, typestyles, and graphic symbol.

4. Trim and frame: 6-inch- (150-mm)- long sections of each profile.

5. Accessories: Manufacturer's full-size unit.

F. Sign Schedule: Use same designations indicated on Drawings.

G. Qualification Data: For Installer and fabricator.

H. Maintenance Data: For signs to include in maintenance manuals.

I. Warranty: Special warranty specified in this Section.

1.05 QUALITY ASSURANCE

A. Installer Qualifications: Fabricator of products.

B. Fabricator Qualifications: Shop that employs skilled workers who custom-fabricate products similar to those required for this Project and whose products have a record of successful in-service performance. Work under this section from manufacturers regularly engaged in work of this magnitude and scope of for five years minimum.

C. Source Limitations for Signs: Obtain each sign type indicated from one source from a single manufacturer.

D. Regulatory Requirements: Comply with applicable provisions in ADA-ABA Accessibility Guidelines and ICC A117.1.

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

1.06 PROJECT CONDITIONS

A. Weather Limitations: Proceed with installation only when weather conditions permit installation of signs to be performed according to manufacturers' written instructions and warranty requirements.

1.07 COORDINATION

A. Coordinate installation of anchorages for post and panel/pylon signage. Furnish setting drawings, templates, and directions for installing anchorages and other items that are to be embedded in concrete.

1.08 WARRANTY

B. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of multi panel base mounted signs that fail in materials or workmanship within specified warranty period.

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

a. Deterioration of metal and polymer finishes beyond normal weathering.

b. Deterioration of embedded graphic image colors and sign lamination

2. Warranty Period: Seven (7) years from date of Substantial Completion.

PART 2 – PRODUCTS

2.01 MATERIALS

A. Aluminum Sheet and Plate: ASTM B 209 (ASTM B 209M), alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated, and with at least the strength and durability properties of Alloy 5005-H32.

B. Aluminum Extrusions: ASTM B 221 (ASTM B 221M), alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated, and with at least the strength and durability properties of Alloy 6063-T5.

C. Fiberglass Sheet: Molded, seamless, thermosetting, glass-fiber-reinforced polyester panels with a minimum tensile strength of 15,000 psi (103 MPa) when tested according to ASTM D 638 and with a minimum flexural strength of 30,000 psi (207 MPa) when tested according to ASTM D 790.

D. Color: As selected by Architect from manufacturer's full range, (dark grey)

2.02 PANEL BOX BASE MOUNTED SIGNS

A. Basis-of-Design Product: Subject to compliance with requirements, provide the product indicated on Drawings or a comparable product by one of the following:

B. ASI - Modulex; Illuminated

C. Base mount pylon.

D. ASI - Modulex 2957 Alt Boulevard, Grand Island, NY 14072; (716) 775-0104, Fax (716) 775-3329; karin.yocum@asimodulex.com, asisignage.com

E. Graphics panel module:

F. Sign panel faces and frame:

G. Custom engineered seamless fiber-reinforced polyester (FRP) consisting of initial gelcoat sealing layer with multilayers of translucent thermoset polyester resin and translucent glass fiber strands in flat sheet maintaining configuration to 0.125" minimum thickness.

H. Internal reinforcing: Encapsulated impact resistant polyurethane core to eliminate oil-canning, surface deflection, and warping and threaded metal inserts for hardware components.

I. Frame: Seamless welded extruded aluminum frame with extruded top hinge and resin hook surface for facer bond.

J. Maximum illuminated graphics area: Complete sign face minus 3" border.

K. Bond faces to extruded aluminum; using exposed fasteners is prohibited.

L. Cabinet: Extruded aluminum containing electrical components and top receiving hinge for panel.

M. Electrical: UL listed LED Modules and ballasts contained in internal raceways; 120/208 and 277 volts, 60 hertz, as indicated on the Electrical Drawings. Verify all circuitry with College Facilities.

1. Disconnect: Provide electrical disconnect switch located within the sign cabinet.

2. Photocell: At Work Areas 1 and 14, provide a photocell mounted on the exterior sign to control on/off function. (These two signs are not fed from an existing lighting circuit). Located photocell inconspicuously.

3. Transformer: Provide all necessary transformers to accommodate various voltages available. Locate the transformer within sign cabinet.

N. Finish and color: Selected by Architect from manufacturer's standard 40 non-glare colors.

O. End shapes: As required to provide weatherproof cabinet.

P. Material: Molded fiberglass; same type construction as sign panel faces except use of translucent resins is not required.

Q. Profile: Refer to Drawings.

R. Finish and color: Selected by Architect from manufacturer's standard 40 non-glare colors per unit.

S. Thickness: refer to drawing

T. Graphics: Artwork supplied by Owner.

U. Special note: Using clear overcoat on completed graphics regardless of colors or types selected is strictly prohibited.

V. Illuminated intaglio integral to finish graphics colors: Selected by Architect from manufacturer's standard five translucent colors indicated in Schedule.

2.03 ACCESSORIES

A. Anchors and Inserts: Provide nonferrous-metal or hot-dip galvanized anchors and inserts for exterior installations and elsewhere as required for corrosion resistance. Use toothed steel or lead expansion-bolt devices for drilled-in-place anchors. Furnish inserts, as required, to be set into concrete or masonry work.

B. Sealant for base mounted modules: Specified in Joint Sealers section.

1. Refer to Section 07 92 00 – Joint Sealants

2.04 FABRICATION

C. General: Provide manufacturer's standard Multi- Panel Base Mounted signs of configurations indicated.

1. Shop assembly:

a. Fabricate units to configurations indicated on reviewed shop drawings. Internally reinforce units in accord with reviewed shop drawings.

b. Furnish copy indicated on reviewed shop drawings in accord with manufacturer's standard procedures.

c. Fabricate posts to lengths required for in-ground mounting.

D. Shop finishing: Finish in accord with color selections indicated on reviewed shop drawings; cover graphics area with removable clear protective film.

1. Welded Connections: Comply with AWS standards for recommended practices in shop welding. Provide welds behind finished surfaces without distortion or discoloration of exposed side. Clean exposed welded surfaces of welding flux and dress exposed and contact surfaces.

2. Mill joints to tight, hairline fit. Form joints exposed to weather to exclude water penetration.

3. Preassemble signs in the shop to greatest extent possible. Disassemble signs only as necessary for shipping and handling limitations. Clearly mark units for reassembly and installation, in location not exposed to view after final assembly.

4. Conceal fasteners if possible; otherwise, locate fasteners where they will be inconspicuous.

2.05 FINISHES, GENERAL

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

C. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in the same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

PART 3 – EXECUTION

3.01 EXAMINATION

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

B. Verify that items, including anchor inserts, and electrical power are sized and located to accommodate signs.

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

3.02 INSTALLATION

A. Excavation: Excavate for sign foundation to elevations and dimensions indicated. Reconstruct subgrade that is not firm, undisturbed, or compacted soil, or that is damaged by freezing temperatures, frost, rain, accumulated water, or construction activities by excavating a further 12 inches (300 mm) backfilling with satisfactory soil, and compacting to original subgrade elevation.

B. Set anchor bolts and other embedded items required for installation of signs. Use templates furnished by suppliers of items to be attached.

1. Install base mounted modules on prepared base; secure to base; caulk joint between module and base with polyurethane sealant specified above and in accord with Joint Sealers section.

2. Protect portion of pylons above ground from concrete splatter.

C. Locate signs and accessories where indicated, using mounting methods of types described and complying with manufacturer's written instructions.

1. Install signs level, plumb, and at heights indicated, with sign surfaces free of distortion and other defects in appearance.

2. Mechanical Fasteners: Use nonremovable mechanical fasteners placed through predrilled holes. Attach signs with fasteners and anchors suitable for secure attachment to substrate as recommended in writing by sign manufacturer.

3. Testing: Test each completed portion of the wiring systems before energized. Test all conductors for opens, shorts and grounds.

4. System Demonstration: Provide thorough, organized instruction regarding equipment and system operation to the College authorized reperentatives.

3.03 CLEANING AND PROTECTION

A. After installation, clean soiled sign surfaces according to manufacturer's written instructions. Protect signs from damage until acceptance by Owner.

B. Remove clear protective film from graphics area.

END OF SECTION 32 30 07

SECTION 32 31 01

VINYL CLAD CHAIN LINK FENCE AND GATES

PART 1 - GENERAL

1.01 DESCRIPTION OF WORK

A. The extent of vinyl clad chain link fence is shown on the drawings and includes, but is not limited to, the following:

1. New 8' high vinyl clad chain link fence and gates.
2. Vinyl privacy slats interwoven in mesh fabric.
3. Re-install existing galvanized fence.

B. Provide all materials, labor, equipment, and services required to accomplish all related work in accordance with the drawings and specifications.

1.02 RELATED WORK SPECIFIED ELSEWHERE

A. Section 312201 - Site Earthwork

B. Section 321301 - Site Concrete Work

1.03 REFERENCES

A. ASTM F552 Standard Terminology Relating to Chain Link Fencing

B. ASTM F567 Standard Practice for Installation of Chain Link Fence

C. ASTM F626 Standard Specification for Fence Fittings

D. ASTM F668 Standard Specification for Polyvinyl Chloride (PVC) and Other Organic Polymer-Coated Steel Chain Link Fence Fabric

E. ASTM F900 Standard Specification for Industrial and Commercial Swing Gates

F. ASTM F934 Standard Specification for Standard Colors for Polymer-Coated Chain Link Fence Materials

G. ASTM F1043 Standard Specification for Strength and Protective Coatings on Steel Industrial Chain Link Fence Framework

H. ASTM F1083 Standard Specification for Pipe, Steel, Hot-Dipped Zinc-Coated (Galvanized) Welded, for Fence Structures

I. ASTM F1184 Standard Specification for Industrial and Commercial Horizontal Slide Gates.

J. WLG 2445 Chain Link Fence Manufacturers Institute, Chain Link Fence Wind Load Guide for the Selection of Line Posts and Line Post Spacing.

1.04 SUBMITTALS

A. Provide Qualification Experience requirements as specified in "Quality Assurance" of this section. Provide a list of completed projects including Owner contact information.

B. Manufacturer's Product Data (MPD): Manufacturer's catalog cuts indicating material compliance and specified options.

C. Shop Drawings: For fence, backstops, and gates including plan layout and details illustrating fence heights, location and sizes of posts, finishes, rails, braces, and installation procedures. Provide footing sizes and hardware list.

D. Samples:

1. 4" section of line post with specified vinyl coating.
2. 12" x 12" section of vinyl fence fabric .
3. PVC privacy slat (6” length sample)

E. Provide a copy of manufacturers 15-year warranty.

1.05 JOB CONDITIONS

A. All job conditions in Section 31 22 01 apply.

B. Construction Review: Notify the Architect when fence and gates are staked out.

1.06 QUALITY ASSURANCE

A. Manufacturer: Company having manufacturing facilities in the United States with five (5) years experience specializing in manufacturing of chain link fence products.

B. Fence Contractor: Contractor having five (5) years experience installing similar projects in accordance with ASTM F567.

C. Tolerances: ASTM current specification and tolerances apply and supersede any conflicting tolerance.

D. Single source: To ensure system integrity obtain the chain link system, framework, fabric, fittings, gates and accessories from a single source.

1.07 WARRANTY

A. Provide manufacturer's standard limited warranty that its chain link fence system is free from defects in material and workmanship including cracking, peeling, blistering and corroding for a period of fifteen (15) years from the date of purchase.

PART 2 - PRODUCTS

2.01 GENERAL

A. Vinyl Chain Link Fence and Gates: Shall conform to Chain Link Fence Manufacturer's Institute specifications. See drawings for sizes of posts and fabric.

B. All posts, rails, fittings, fabric and tension bars shall be vinyl coated galvanized steel, painting of these items will not be acceptable.

C. Color System: All posts, rails, fittings, fabric, hardware, and tension bars shall be black in compliance with ASTM F934.

D. Standard of quality: shall be Color Bond II, Class 2b as manufactured by Merchant Metals, (888) 260-1600 or Architect approved equal.

2.02 CHAIN LINK FABRIC

A. The base metal of chain-link fabric is composed of commercial quality medium high carbon, hot-dipped galvanized steel wire. Core wire tensile strength 75,000 psi.

B. The vinyl coating is securely fused over the galvanized steel wire by the Thermal Fusion process under pressure to 5,000 psi to insure a dense and impervious covering free of voids, having a smooth and lustrous surface appearance. The vinyl coating thickness, 6 mil (0.15 mm) to 10 mil (0.25 mm), zinc coating weight, and wire tensile strength conforms to ASTM F668 Class 2B. The wire shall be vinyl clad before weaving and is free and flexible at all joints. The mesh is measured by the distance between the wires forming parallel sides of the mesh. The height of the fabric, measured from the ends of the knuckles, has a permissible variation of plus or minus one inch.

C. Wire Coating: Only Plasticized Polyvinyl Chloride (PVC) with low temperature (-20 degrees C.) plasticizer, no fillers, extenders or extraneous matter, other than the necessary stabilizers and pigments are used. Colors are stabilized and have a light fastness that withstands a minimum WEATHER-O-METER exposure of 4,000 hours without any deterioration (Test Equipment Operating Light and Water Exposure Apparatus Carbon-Arc Type) ASTM-D 1499. The vinyl covering, in addition, resists attack from prolonged exposure to diluted solutions of most common mineral acids, sea water and diluted solutions of most salts and alkali.

D. Fabric is knuckled at both selvages (top and bottom). Any twisted salvage will be rejected.

E. Mesh size and Gauge 2" (50 mm) 1290 lbF 9 ga. [0.148" (3.76 mm)]

2.03 STEEL PIPE FRAME WORK

A. Steel pipe Type I: ASTM F1043 Group IA, ASTM F1083 standard weight schedule 40 hot-dip galvanized pipe having a zinc coating of 1.8 oz/ft² (550 g/m²) on the outside and 1.8 oz/ft² (550 g/m²) on the inside surface. Exterior of pipe to have ASTM F1043 PVC thermally fused color coating, minimum thickness 10 mils (0.254 mm) to 15 mils (0.38 mm). Regular Grade: Minimum steel yield strength of 30,000 psi (205 MPa) [all sizes]

B. Top, Intermediate and Bottom Rails: Top rail is thermally fused vinyl coated galvanized steel pipe in 21 foot lengths jointed by 7" inches long sleeves, vinyl clad, to run continuously along top of fence. Bottom and intermediate rails shall conform to specifications for top rail and are jointed at line posts with vinyl clad boulevard clamps.

C. Line Posts: Line posts are thermally fused vinyl coated galvanized steel pipe. Posts are sufficient length to allow for installation as detailed and are spaced in the line of fence not farther apart than 10 feet.

D. Terminal and Corner Posts: Shall be thermally fused vinyl coated galvanized steel. Each post is of sufficient length to allow for a depth as detailed. Fabric is attached to the terminal post by means of vinyl coated tension bars and held by vinyl coated tension bands. Corner posts are placed at each change in direction or as directed by the Architect. All corner and terminal posts are braced with vinyl-clad galvanized steel 1.66

inch O.D. brace, rail, 10 feet long, with a diagonal 3/8 inch diameter truss rod, and attached to the first adjacent line post.

2.04 FITTINGS

A. All fittings to be PVC thermally fused color coated having a minimum thickness of 0.006" (0.152 mm) per ASTM F626. PVC color to match fabric and framework. Moveable parts, nuts and bolts to be field coated with PVC liquid touch up after installation.

B. Post caps: ASTM F626 galvanized pressed steel, malleable iron, or aluminum alloy weather tight closure cap for tubular posts. Provide one cap for each post. For top rail, provide line post loop tops to secure top rail.

C. Rail ends: Galvanized pressed steel per ASTM F626, for connection of rails to post using a brace band.

D. Top rail sleeves: 7" (178 mm) PVC coated galvanized steel sleeve per ASTM F626 that allow for expansion and contraction of rail.

E. Wire ties: 9 gauge (0.148") (3.76 mm) vinyl coated galvanized steel wire for attachment of fabric to line posts and rails. Tie wire PVC coated and in compliance with ASTM F626. Color to match fabric color.

F. Brace and tension (stretcher bar) bands: ASTM F626 galvanized 12 gauge (0.105") (2.67mm) pressed vinyl coated steel by 3/4" (19mm) formed to a minimum 300 degree profile curvature for post attachment. Secure bands using minimum 5/16" (7.94 mm) galvanized carriage bolt and nut.

G. Tension (stretcher) vinyl coated galvanized steel bars: One piece lengths equal to 2 inches (50 mm) less than full height of fabric with a minimum cross-section of 3/16" x 3/4" (4.76 mm x 19 mm) per ASTM F626. Provide tension (stretcher) bars where chain link fabric is secured to the terminal post.

H. Truss rod assembly: PVC coated galvanized steel minimum 5/16" (7.9mm) diameter truss rod with pressed steel tightener, in accordance with ASTM F626.

I. Carriage bolts and nuts: Galvanized of commercial quality but not vinyl coated. Provide PVC touchup paint to color coat all nuts and bolts, when fence is completed.

2.05 CHAIN LINK SWING GATES

A. Swing gates: Fabricate chain link swing gates in accordance with ASTM F900. Gate frame to be of welded construction. Weld areas to be protected with zinc-rich paint per ASTM A780 then over coated with liquid PVC to match frame. The gate frame members are to be spaced no greater than 8' 0" (2.44 m) apart horizontally or vertically. Exterior members to be 1.900" (48.3 mm) OD pipe, interior members when required shall be 1.660" (42.2 mm) OD pipe. PVC coated pipe to be [Grade 1 ASTM F1083] per section 2.3. Chain link fabric to match specification of fence system. Fabric to be stretched tightly and secured to vertical outer frame members using tension bar and tension bands spaced 12" (304.8 mm) on center and tied to the horizontal and interior members 12" (304.8 mm) on center using 9 gauge vinyl coated galvanized steel ties per section 2.4.

B. Hinges: Hot dip galvanized powder coated pressed steel or malleable iron, structurally capable of supporting gate leaf and allow opening and closing without binding. Non-lift-off type hinge design shall permit gate to swing 180°.

C. Latch: Powder coated galvanized forked type capable of retaining gate in closed position and have provision for padlock. Latch shall permit operation from either side of gate.

D. Double gates: Provide powder coated galvanized drop rod with center gate stop pipe or receiver to secure inactive leaf in the closed position. Provide powder coated galvanized pressed steel locking latch, requiring one padlock for locking both gate leaves, accessible from either side.

E. Latch, hinges, moveable parts shall be field coated with liquid PVC.

F. Gate posts: PVC color coated Grade 1 pipe ASTM F108 per section 2.03.

2.06 PRIVACY SLATES

A. High density polyethylene (HDPE), with color pigments and ultra violet (UV) inhibitors.

B. Inter-woven with fabric mesh and interlocking at top and bottom of fabric.

C. Color: Black

2.07 CONCRETE FOOTINGS

A. Shall be 4,000 psi as specified in Section 32 13 01, 2.01.

PART 3 - EXECUTION

3.01 SITE EXAMINATION AND PREPARATION

A. Ensure property lines and legal boundaries of work are clearly established.

B. Survey of fence location to be provided by Site Contractor.

C. Clearing: The Site Contractor shall clear, grub and remove vegetation/debris for the fence installation area.

D. Verify areas to receive fencing are completed to final grade with finished elevations shown on the drawings.

3.02 CHAIN LINK FRAMEWORK INSTALLATION

A. Install chain link fence system in accordance with ASTM F567, manufacturer's instructions, and Chain Link Fence Manufacture's Institute specifications.

B. Locate terminal post at each fence termination and change in horizontal or vertical direction of 30° or more.

C. Space line posts uniformly maximum ten (10') feet on center.

D. Excavation: Drill holes of diameters and spacings shown, for post footings in firm, undisturbed or compacted soil.

1. Excavate hole depths as detailed when in firm, undisturbed soil. Excavate deeper as required for adequate support in soft and loose soils, and for posts with heavy lateral loads.

2. Spread soil from excavations uniformly adjacent to the fence line, or on adjacent areas of the site, as directed.

E. Setting Posts: Remove all loose and foreign materials from sides and bottoms of holes.

1. Center and align posts in holes. Install posts plumb, in neat, straight lines, and with minimal waviness of top railing.

2. Place concrete around posts in a continuous pour, and vibrate or tamp for consolidation. Check each post for vertical and top alignment, and hold in position during placement and finishing operations.

3. Trowel finish tops of footings, and dome surface to direct water away from posts. Extend footings for posts as detailed.

4. Keep exposed concrete surfaces moist for at least 7 days after placement, or cure with curing material, or other acceptable method.

F. Concrete Strength: Allow concrete to attain at least 75% of its minimum 28-day compressive strength, but in no case sooner than 7 days after placement, before rails, tension bands or fabric is installed. Do not stretch and tension fabric and wires, and do not hang gates until the concrete has attained its full design strength.

G. Check each post for vertical and top alignment, and maintain in position during placement and finishing operations.

H. Bracing: Install horizontal brace and truss assembly at mid-height or above for fences 6’ (1829 mm) and over at each fabric connection to the terminal post. The diagonal truss rod is installed at the point where the brace rail is attached to the terminal post and diagonally down to the bottom of the adjacent line post. Place the truss rod in tension by adjusting the turnbuckle.

I. Top rail: Install in lengths of 21’ (6.400 m). Connect ends with sleeves forming a rigid connection, allow for expansion and contraction.

J. Center Rails: Install mid rails between line posts and attach to post using rail end or line rail clamps. A center rail is required for fabric height 8'-0" and over.

K. Bottom Rails: Install bottom rails between posts and attach to post using rail end or line rail clamps.

L. Fasteners: Peen ends of bolts or score threads to prevent removal of nuts. Paint all exposed surfaces, nicks or scratches, nuts and bolts, with liquid black PVC touch up paint.

3.03 CHAIN LINK FABRIC INSTALLATION

A. Fabric: Install fabric on security side or play side for athletic facilities as directed by the Architect, pull fabric taut; thread the tension bar through fabric and attach to terminal posts with tension bands spaced maximum of 15” (381 mm) on center and attach so that

fabric remains in tension after pulling force is released. Install fabric so that it is above finish grade as detailed.

B. Secure fabric using wire ties to line posts at 12" on center and to rails and braces 12" on center. Tie wire shall be secured to the fabric by wrapping it two (2), 360 degree turns around the chain link wire pickets. Cut off any excess wire and bend back so as not to protrude so as to avoid injury if a pedestrian may come in contact with the fence.

3.04 CHAIN LINK GATE INSTALLATION

A. Swing gates: Installation of swing gates and gate posts shall be per ASTM F567. Direction of swing shall be as shown on drawings and/or as directed by the Owner. Gates shall be hung plumb in the closed position with minimal space from grade to bottom of gate leaf. Double gate drop bar receiver shall be set in a minimum concrete footing 12” diameter by 48” deep. Gate leaf holdbacks shall be installed on all double gates and all gate leafs greater than 5’ (1524 mm) in width as directed by the Owner, if required.

3.05 ACCESSORIES

A. Install privacy slats per manufacturer’s instructions, secure with fence mesh.

3.06 REINSTALL EXISTING GALVANIZED FENCE

A. Match existing galvanized chain link fence height and materials. Terminate fence at building face as shown on the plans. Cut fence fabric as necessary and stretch tight and secure.

3.07 CLEAN UP

A. During the contract and at intervals as directed by the Architect and as chain link fence, backstop and gate installation is completed, clear the site of all extraneous concrete, gravel, fence material or debris. Leave the site in a clean, safe, well draining, neat condition.

END OF SECTION 32 31 01

SECTION 32 90 01
PLANTING

PART 1 - GENERAL

1.01 DESCRIPTION OF WORK

A. The extent of planting is shown on the drawings.

B. Planting work includes, but is not limited to, the following:

1. Planting Soil Mix and preparation (borrow topsoil)
2. Planting commercially grown trees and shrubs
3. Planting accessories
4. Maintenance: See watering, weed control, pruning and other specific requirements
5. Landscaping stone – Bio swale
6. Guarantee
7. Clean up

C. The Contractor shall provide materials, labor, equipment, and services required to accomplish related work in accordance with the drawings and specifications.

1.02 RELATED WORK SPECIFIED ELSEWHERE

A. Section 312201 - Site Earthwork

B. Section 329201 - Lawns

1.03 SUBMITTALS (See Section 311201, 1.5)

A. Furnish name of Landscape Contractor and/or Nurseryman to perform planting work and obtain Architect's approval.

B. Provide Material Certificates, MPD, Test Reports or Samples as noted for:

1. Mulch: Twelve (12 oz.) ounce sample
2. Planting Soil Mixture: Material Certificate, Source and Test Report. See 1.4 F.
3. Plant Materials: Certificates of Inspection by regulatory agencies. Leave tags with botanical names and nursery source(s) on plants until reviewed by Architect.
4. Photos of large landscaping boulders.
5. Photos of river rockmulch.

1.04 QUALITY ASSURANCE

A. Perform planting in compliance with applicable requirements of governing authorities having jurisdiction.

B. Planting Contractor: Planting work by established Landscape Contractor and/or Nurseryman having sufficiently experienced crews, supervisor(s), specialized equipment and an excellent record of performance on completed planting projects of comparable size, scope, and quality. Provide expert plantsman to direct the work in the field on a regular, daily basis.

C. Nomenclature: Plant names shall conform to the latest edition of "Standardized Plant Names" as adopted by the American Joint Committee of Horticultural Nomenclature. Plants shall be true to botanical name, tagged with a waterproof, legible tag showing botanical name, size, and nursery source of origin.

D. Size and Grading: Plant sizes and grading shall conform to the latest edition of "American Standard for Nursery Stock" as sponsored by the American Association of Nurserymen, Incorporated (AAN), latest issue unless otherwise specified.

E. Nursery Source: Obtain freshly dug, healthy, vigorous, plants nursery grown under climatic conditions similar to those in the locality of the project for a minimum of two (2) years. Plants shall have been lined out in rows, annually cultivated, sprayed, pruned, and fertilized in accordance with good horticultural practice. Plants shall have been transplanted or root pruned at least once in the past three years. Balled and burlapped plants must come from soil which will hold a firm root ball. Heeled in plants and plants from cold storage not accepted.

F. Testing:

1. Engage an independent, qualified State of New York soil testing service. Pay for soil testing and inspection services.

2. Test representative material samples proposed for use as follows:

a. Planting Soil Mixture

(1) pH factor
(2) Mechanical analysis
(3) Percentage of organic content
(4) Recommendations on type and quantity of additives required to establish satisfactory pH factor and supply of nutrients to bring nutrients to satisfactory level for planting.

b. Peat Moss

(1) Loss of weight by ignition
(2) Moisture absorption capacity

c. Bone Meal

1.05 JOB CONDITIONS

A. Job conditions in Section 312201 apply.

B. Planting seasons and timing conditions:

1. Unless otherwise directed in writing by the Architect, the planting of trees, shrubs, and perennials shall be from in the Spring, March 15 to June 1, and in the Fall, from October 15 to December 15. Refer to 1.5 Fall Planting Hazard restrictions below.

2. Proceed with and complete planting work as rapidly as portions of the site become available, working within the seasonal limitations for each kind of landscape work required.

3. Do not conduct planting operations until fine grading in the work areas has been completed satisfactorily.

4. Cooperate with other Contractors and trades working in and adjacent to planting locations. Examine drawings and specifications for the entire site and become familiar with the scope of other work required, especially underground utilities.

C. Construction Review:

1. Plants must be reviewed by the Architect before planting, either at the site or at the nursery.

2. Notify the Architect forty-eight (48) hours prior to delivery of plant materials to the site.

3. Plants not meeting specifications or not installed according to drawings may be rejected at any time by the Architect.

D. Provide plants of the species, size, and special characteristics noted on the Plant List. Substitutions not permitted unless approved in writing by the Architect. In the event that quantity discrepancies or material omissions occur in the Plant List, the planting drawings shall govern.

E. Owner shall furnish water at the building face(s). Contractor shall provide labor, hoses, sprinklers and watering equipment.

F. Fall Planting Hazard (FPH):

1. Notify the Architect in writing when any of the proposed plants are sensitive to fall planting in the experience of the Contractor. Plant materials noted as FPH in the PLANT LIST shall be planted in the Spring season. Assume sole responsibility of plant health related to materials noted FPH which are fall planted. Replace unhealthy or dead plants as described in the Guarantee.

2. Plants considered very risky to transplant in the fall include, but are not limited to, the following.

Acer rubrum & vars.	Platanus acerifolia
Betula varieties	Prunus - Stone fruits
Carpinus varieties	Pyrus - Pears
Cornus florida & vars.	Quercus - Oaks
Crataegus varieties	Salix - weeping vars.
Halesia	Strax japonica
Koelreuteria	Tilia tomentosa
Liquidambar styraciflua	Zelkova varieties
Liriodendron tulipifera	Pinus nigra

3. Evergreen plant materials are also considered a fall planting hazard.

PART 2 - PRODUCTS

2.01 PLANTS

A. Plants shall be well formed without voids and open spaces, typical of their species or variety, with normal habit of growth. Plants shall be first quality, sound, healthy, vigorous, well branched and densely foliated. Plants shall have healthy, well developed fibrous

root systems. They shall be free of defects, disfiguring knots, sunscald injuries, frost cracks, abrasions, disease, insect pests, eggs, and larvae.

B. Plants shall conform to the measurements specified in the Plant List. Measurements specified shall be minimum size acceptable for each variety. For each plant of minimum size, provide a plant of maximum size. Plants that meet the requirements specified in the Plant List, but do not possess a normal balance between height and spread will not be accepted. Plants for use when symmetry is required, or in rows, shall be matched as possible. Plants shall not be pruned prior to delivery.

C. Plants and tree trunks shall be measured when the branches are in their normal position. Dimensions for height and spread as contained herein refer to the main body of the plant and not from branch-tip to branch-tip. Shade trees shall be free of branches up to seven feet, with a single leader, well branched and straight stems. No trees which have had their leaders cut or damaged will be accepted. Trees must have straight trunks with single leader intact. There shall be no abrasion of the bark and no fresh cuts of limbs over one (1") inch which has not been completely calloused over.

D. Balled and burlapped plants with firm, natural balls of earth of sufficient diameter and depth to encompass the fibrous and feeding root system necessary for full recovery of the plant. Provide ball sizes complying with the latest edition of the "American Standard for Nursery Stock." Cracked or mushroomed balls are not acceptable.

E. Container-grown stock: Grown in a container for sufficient length of time for the root system to have developed to hold its soil together, firm and whole.

1. No plants shall be loose in the container.

2. Container stock shall not be pot bound.

F. Evergreen trees shall be fully branched to the ground. (Park Standard)

2.02 PLANTING ACCESSORIES

A. Planting soil mixture for trees, shrubs and plant beds shall be premixed in bulk, and contain the following by volume:

20 parts clean on site sub-soil, free of shall, clay, large stones and other debris
10 parts screened imported topsoil*
1 part bone meal

* If on-site urban soils are unavailable or unsuitable, substitute 50% course non-limestone sand, and 50% compost/ organic mix.

B. Imported Topsoil: 10-20% organic, 20-65% passing 200 mesh sieve. Fertile, friable, natural topsoil of leafy character, without admixture of subsoil material, obtained from a well-drained arable site, reasonably free from clay, lumps, coarse sand, stones, plants, roots, sticks, and other foreign materials, with acidity range of between pH 6.5 and 7.5, free of substances harmful to plants which will be grown in the soil.

C. Starter Fertilizer: Water soluble fertilizer and plant food 10-52-17 containing no sulfate or chloride salts. Standard of quality shall be as manufactured by Fairlawn Chemical Co., Inc., 485 Holt Road, Webster, NY (585) 671-2400, and distributed by Organix, 569 Klem Road, Webster, NY (585) 787-2711 or Architect approved equal.

D. Peat Moss: Brown to black in color, weed and seed free, dried sphagnum peat moss, containing not more than 9% mineral on a dry basis and conforming to NYSDOT 713-20.

E. Bone Meal: Finely ground, raw, minimum 4% nitrogen and 20% phosphoric acid. It shall be delivered in sealed bags showing the manufacturer's guaranteed analysis.

F. Stakes: Minimum eight (8') foot long, two (2") inch round or square sound wood stakes.

G. Hose: New, two (2) ply garden hose not less than one-half (1/2") inch in diameter.

H. Guy Wire: 10-gauge galvanized steel wire for guying plantings where specified.

I. Tree Wrap: Standard of quality shall be four (4") inch wide waterproof 30-30-30 Krinklecraft, or Architect approved equal.

J. Mulch: Natural ground or shredded bark, medium size, from softwood trees. No pieces over two (2") inches in greatest dimension. Free from sawdust, stones, debris, and deleterious materials. (Dyed wood-mulch is not acceptable).

K. Anti-desiccant: Standard of quality shall be "Wiltpruf" or Architect approved equal.

2.03 LANDSCAPING STONE

A. Large landscape boulders: Glacial deposit field stone or river stone, ranging in size from 1-cubic foot to ½ cubic yard stones. Mostly round, non-fractured surfaces. Sizes and color to be approved by the Architect.

Quantity: Minimum of 60 large stones, (50% larger than 5 cubic feet).

B. River rock mulch: Natural stone found in run-of-bank gravel deposits, field stone or river beds. Mostly round, ranging in color and sizes between 1-inch to 8-inch diameter.

PART 3 - EXECUTION

3.01 LAYOUT: Locate and stake in the field individual trees, shrubs, and plant beds for approval by the Architect prior to commencing planting operations. Adjust plant beds, spacing of materials, and plant groupings as directed by the Architect.

3.02 GENERAL PLANTING OPERATIONS

A. Transportation and Handling: Take precautions customary in good trade practice in preparing plants for moving. Workmanship that fails to meet the highest standards will be rejected. Spray deciduous plant's foliage with an approved "Anti-Desiccant" immediately after digging to prevent dehydration. Dig, pack, transport, and handle plants with care to ensure protection against injury. Do not hold or move trees by stems. Support and protect root balls.

B. Inspection certificates required by law shall accompany each shipment invoice or order to stock and on arrival, the certificate shall be filed with the Architect.

C. Protect plants from drying out. When plants cannot be planted immediately upon delivery, properly protect them with soil, wet peat moss, or in a manner acceptable to the Architect. Water heeled-in plantings daily. No plant shall be bound with rope or wire in a manner that could damage or break the branches. Cover plants transported on open

vehicles with protective covering to prevent wind burn. Do not hold or move trees by stems. Support and protect root balls.

D. Provide dry, loose prepared planting soil for planting bed mixes. Frozen or muddy soil is not acceptable.

E. Excavate tree pits, shrub and planting beds as dimensioned and located on drawings. When soils harmful to plant materials are encountered, immediately notify the Architect.

F. Plants shall be set plumb and straight and at such a level that after settlement, a normal or natural relationship of the crown of the plant with the ground surface will be established. Each plant shall be planted in the center of the pit. When balled, burlapped, and platformed plants are set, the platform shall first be removed from the pit and topsoil shall be carefully tamped under and around the base of each ball to fill voids. Burlap, ropes, and wires shall be removed from the sides and tops of balls, but no burlap shall be pulled out from under the balls.

G. Plants shall be planted in the planting soil mixture which shall be thoroughly watered and tamped. On level ground or slight slopes, a shallow basin a little larger than the diameter of the plant pit shall be left around each plant as shown on the drawings or as directed by the Architect. On steep slopes, the soil on the lower side of the plant shall be graded in such a manner that it will catch and hold water as shown on the drawings or as directed by the Architect.

H. Staking: Trees two (2") inch caliper or less shall be staked with two stakes. The trunks of trees larger than two (2") inches shall be staked with three stakes, equally spaced about the tree, set vertically and securely fastened. The trees shall be guyed with two or three strands of wire as specified, which shall run through the rubber hose and be securely tightened.

I. Mulching: Spread continuous four (4") inches settled depth of mulch over finished surface of each plant, plant bed, or hedge trench as detailed. Water plants thoroughly after mulching. NOTE: The Architect may field check depth of mulch for proper weed control barrier since no weed control fabric is required.

J. Wrap deciduous trees with tree wrap to first branch and secure wrap.

K. Pruning: Each shrub or tree shall be pruned to preserve the natural character of the plant. Remove dead wood and crossing branches. Do not prune terminal leaders. Refer to drawings for additional tree pruning details.

L. Anti-Desiccant: Immediately after planting and staking, trees and shrubs shall be sprayed with anti-desiccant, using an approved power sprayer to apply an adequate film over trunks, branches, twigs, and/or foliage. Apply according to manufacturer's recommendations.

M. Replacements: Remove and immediately replace plants, as determined by the Architect, to be unsatisfactory during the initial planting installation.

3.03 LANDSCAPE BOULDERS

A. Arrange boulders as detailed and as directed by the Architect. Slightly embed large boulders to prevent rocking. Arrange boulders in a natural appearance to mimic a stream bed, (boulders shall not be dumped).

B. Install smaller river stone along the SMT drain line and create small pools to collect water run-off.

3.04 MAINTENANCE

A. Maintenance by Contractor begins as soon as plants are installed. Protect plants from drought, washout and wind erosion. In general, maintain new plantings, including watering, weeding, pruning, applications of herbicides, fungicides, insecticides and pesticides, until healthy, vigorous plants are accepted by the Architect. Specifically:

1. Protect: Protect plantings against harsh weather, trespass and vandalism by wrapping, staking, temporary fencing or other means.

2. Water: The Owner shall furnish water at the building face(s). The Contractor shall provide labor, hoses, sprinklers and watering equipment to maintain plants, prevent them from drying (browning) out, and keep plants in a healthy, growing condition until final acceptance.

3. Cultivate: Cultivate plants by straightening any settled plant materials, re-staking and guying, rewrapping, pruning dead and broken branches, weeding and re-applying anti-desiccant, herbicide, fungicide, insecticide and pesticide.

4. Should the Contractor fail to protect and maintain the plantings, the Owner may issue a three (3) day notification to the Contractor, hire work done, and back charge this Contractor.

B. Maintenance by the Contractor continues until Certificate of Final Acceptance, or Final Punch List is satisfactorily completed and accepted by the Architect, whichever is later. Maintenance by Owner begins as soon as the Architect issues Certificate of Final Acceptance or Final Punch List is satisfactorily completed and accepted by the Architect, whichever is later.

3.05 STANDARDS FOR ACCEPTANCE: Review to determine acceptance of plantings will be made by the Architect upon request. Provide notification at least five (5) working days before requested review date.

A. New plantings will be acceptable provided requirements, including maintenance, have been complied with. Healthy, well-formed, vigorous plants, true to species and size on Plant List, must be established, free of disease, broken branches and insects.

B. Any plant which is poorly formed, structurally unsound, not true to species and size on Plant List, diseased, contains broken branches, or is unhealthy (containing 25% or more browned out foliage), shall be rejected and replanted at no additional cost to the Owner.

3.06 GUARANTEE

A. Contractor shall guarantee plant materials to be true to species and size on Plant List, and in vigorous growing condition, for a period of one (1 yr.) year from the date given on the Certificate of Substantial Completion or Final Punch List is satisfactorily completed and accepted by the Architect, whichever is later.

B. Any plant material that does not meet the Standards for Acceptance shall be replaced as soon as weather conditions permit. Replacement plantings shall be made in accordance with the specifications and drawings. Replacements shall be subject to inspection,

acceptance, and guaranteed for one (1 yr.) year after date of replanting and acceptance by the Architect.

3.07 CLEAN UP

During the contract and at intervals as directed by the Architect and as planting is completed, clear the site of extraneous materials, pots, flats, hose, wire, stakes, pruned branches, rubbish, mulch and debris. Leave the site in a clean, safe, neat, well draining condition.

END OF SECTION 32 90 01

SECTION 32 92 01
LAWNS

PART 1 - GENERAL

1.01 DESCRIPTION OF WORK

A. The extent of the lawn work is shown on the drawings. The lawn work limits equal the Contract Limit Line except as noted on the drawings. Non-paved, non-roofed areas within the Contract Limit Line shall receive four (4") inches settled depth of topsoil and lawn seed or sod. Existing lawn areas that are not disturbed require no additional work. Lawn types as shown on the drawings are defined as follows:

1. Lawn Type 1: Provide 4" screened imported topsoil, seed, and mulch.
2. Lawn Type 2: Provide 4" screened imported topsoil, sod

B. Lawn work includes, but is not limited to, the following:

1. Providing mechanically screened topsoil
2. Lawn bed preparation
3 Seeding lawns
4 Sodding lawns
5. Mulching and fertilizing
6. Maintenance: See watering, mowing, fertilizing, weed control
7. Clean Up

C. Provide materials, labor, equipment, and services required to accomplish related work in accordance with the drawings and specifications.

1.02 RELATED WORK SPECIFIED ELSEWHERE

A. Section 312201 - Site Earthwork

B. Section 329001 - Planting

1.03 REFERENCES

A. ASTM D4972 - Standard Test Method for pH of Soils

B. ASTM D5268 - Standard Specification for Topsoil Used for Landscaping Purposes

C. ASTM D422 and D1140 - Standard Test Method for Particle Size Analysis of Soils

D. ASTM D698 - Standard Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effect

E. ASTM F1647 - Standard Test Method for Organic Material Content of Athletic Field Rootzone Mixes.

F. ASTM F1632 - Standard Test Method for Particle Size Analysis and Sand Shape Grading of Golf Course Putting Green and Sportsfield Rootzone Mixes

G. ASTM F2060 - Standard Guide for Maintaining Cool Season Turfgrasses on Athletic Fields

H. National Turfgrass Federation, Inc.

I. National Turfgrass Evaluation Program (NTEP).

J. Cornell Universities: Sportsfield Management Guidelines

K. Turfgrass Producers International: Guideline Specifications to Turfgrass Sodding, latest edition.

1.04 SUBMITTALS: (See Section 311201, 1.5)

A. Furnish name of Landscape Contractor or Nurseryman to perform lawn work and a list of completed projects including contact information for each project demonstrating compliance with applicable qualification requirements outlined in 1.5 "Quality Assurance" of this specification section.

B. Provide Material Certificates and MPD for:

1. Seed species and source
2. Sod species, sod grower/ producer
3. Limestone
4 Fertilizers
5. Hydro mulch
6. Straw (dry mulch) - location of straw producer

C. Provide Topsoil Test Report for Imported Topsoil: Submit test results from Architect approved independent testing laboratory on their letterhead. Report shall:

1. Certify soil texture, organic content, and particle size analysis.
2. Chemical analysis testing nitrogen, phosphorus, potassium, calcium, magnesium, cation exchange capacity, base saturation percentages, micronutrients and acidity (pH).
3. Provide timing and rates of soil additives, liming and fertilizers. (Materials and procedures regarding soil amendments and fertilizers specified in this section are approximate.) Adjust all soil amendments to comply with test results based on actual soil tests and as directed by the Architect at no additional cost to the Owner.

D. Lawn Seed Mix: Submit one (1 lb.) pound seed sample for each mix specified in supplier's unopened package with supplier's certification statement clearly showing the following:

1. Name and address of labeler
2. Lot number
3. Kind and variety of turfgrass seed listed in order of predominance
4. Percent by weight of pure seed of each species and variety (percent purity)
5. Germination percentage (percent viable seed)
6. Percent by weight of other crop seed
7. Percent by weight of weed seed
8. Percent undesirable grass seed
9. Percent by weight of inert matter
10. Date on which the germination test was conducted

E. Submit seed tags from **ALL** used or partially used seed bags. At times throughout the project, the Architect may request seed samples of onsite seed bags.

F. Provide schedule for review and approval as outlined under "Sequence and Scheduling" of this specification section.

1.05 QUALITY ASSURANCE

A. General: Work shall be contracted to a single, established Landscape Contracting or Nursery firm having sufficiently experienced crews, supervisor(s), specialized equipment, and an excellent record of performance on completed lawn projects of comparable size, scope, and quality. Provide expert turfman to direct the work in the field on a regular, daily basis. The expert turfman shall be employed by the same company engaged in the installation of the lawn work for a minimum of five (5) years.

B. Nomenclature: Seed names shall conform to the National Turfgrass Federation, Inc.

C. Seed Quality Rating: Shall meet testing standard for New York State outlined by the National Turfgrass Evaluation Program (NTEP).

D. Sod Standards: Comply with the Turfgrass Producers International: Guideline Specifications to Turfgrass Sodding, latest edition.

E. Testing: If required by the Architect for poor lawn grow in, engage an Architect approved independent, qualified New York State testing service and turfgrass specialist to evaluate Contractor grow in practices and materials used. Pay for all testing/inspection services, materials, and manpower to correct lawn areas as approved by the Architect.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Seed:

1. Packing and Shipping: Ship seed and associated materials with certificates of inspections required by governing authorities.

2. Do not make substitutions. If specified seed material is not obtainable, submit to the Architect proof of non-availability and a proposal for use of equivalent material with similar performance criteria as the originally specified seed material.

3. Store all seed at the site in a cool, dry place in a manner to prevent wetting and deterioration, as approved by the Architect. Replace any seed damaged during storage as directed by the Architect.

4. Deliver seed in supplier's unopened packages bearing labels showing the supplier's name and seed analysis by weight.

B. Sod:

1. Cut, deliver, and install sod within a **24-hour period**. Sod cutting and shipping shall be coordinated with the sod installers. Only supply a quantity of sod that can be installed within the 24-hour limit.

2. Do not harvest or transport sod when moisture content may adversely affect sod survival.

3. Protect sod from sun, wind, and dehydration prior to installation.

4. Do not tear, stretch or drop sod during handling and installation.

5. Store sod materials at site in an orderly manner at location(s) acceptable to the Architect.

C. Fertilizer:

1. Deliver fertilizer in the manufacturer's standard sized bags showing the weight, analysis, and manufacturer's name. Store all fertilizer under a waterproof cover or in a dry place as approved by the Architect.

1.07 JOB CONDITIONS

A. Job conditions in Section 312201 apply.

B. Lawn Work:

1. Perform lawn work after planting, fine grading and other work affecting the ground surfaces in the lawn work areas has been completed satisfactorily.

2. Where practical, the Owner will provide a connection to the water system such as, but not limited to, existing yard hydrants, building hose bibs, etc. If this source is insufficient, not available or practical to provide a source of sufficient water to meet the requirements herein, the Contractor shall secure a water source sufficient to meet the water requirements herein such as, but not limited to, municipal hydrants, water truck, etc. at no additional cost to the Owner.

3. Contractor shall provide all watering equipment and appurtenances such as, but not limited to, meters, backflow preventer, labor, hoses, sprinklers, irrigation and watering equipment.

4. Calendar dates for seeding and sodding under "Sequence and Scheduling" of this specification section shall apply.

5. For seeded lawn, perform lawn seeding using mechanical and hand seeding methods. Hydro-mulching is permitted when adjacent pavements, buildings, site features or finished surfaces are protected from over-spray.

6. Place sod only when ground surface is free of mud, frost, snow and ice.

7 Protect newly seeded lawns from vehicles, vandalism, or trespass. Provide temporary fencing or barriers as required.

C. Construction Review:

1. Upon completion of topsoil spreading and/or seed bed preparation, notify Architect to review work.

2. The Architect may review fine graded areas by the Contractor to check for surface smoothness and general compliance with grading requirements. Fill or cut by hand raking or other acceptable means to achieve smooth, even well-draining lawn surfaces free of "bird baths" and breaks in grade as directed by the Architect at no additional expense to the Owner.

3. Review of any fine graded lawn areas by Architect shall not alleviate the Contractor of his responsibility for conforming to the required grades as shown on the drawings, nor be misconstrued as final acceptance of lawn work.

1.08 SEQUENCING AND SCHEDULING

A. Schedule: Prior to construction, provide a schedule which addresses the following lawn thresholds involving erosion control stabilization, substantial completion, and Owner occupation.

1. Lawn work: The Contractor may invoice for 50% of the approved schedule of value breakdown at the time of acceptable installation.

a. Unless otherwise directed in writing by the Architect, seed and sod lawns from April 1 to May 15, and from August 15 to October 1. Seeding and sodding between May 16 and August 14 is not acceptable unless adequate water supply is available and applied to the turfgrass as required herein and approved by the Architect.

b. Proceed with and complete seeding as rapidly as portions of the site become available, working within the seasonal limitations for each kind of landscape work required.

2. Substantial Completion: At this time, the Architect may issue the Notice of Termination to satisfy the NYS DEC stabilization requirements. The date of substantial completion is anticipated approximately 60 days after lawn installation presuming all Contractor maintenance operations have been vigorously performed.

3. Final Acceptance: The Contractor may invoice for the final 50% of the approved schedule of value breakdown at the time of final acceptance as described in Part 3, "Standards for Final Acceptance of Lawns" of this specification section. The date of final acceptance is anticipated approximately 30 days after substantial completion presuming all Contractor maintenance operations have been vigorously performed.

4. Owner Maintenance: After final acceptance of the lawns, the Owner will maintain lawns.

PART 2 - PRODUCTS

2.01 TOPSOIL

A. Source: Imported from off site, (borrow) Architect approved source, when amended quantity is inadequate to provide four (4") inches settled depth of topsoil for all lawn areas. **(Imported topsoil included in the contract price).**

B. Texture and Content: Provide topsoil conforming to the following:

1. Soil texture and content:

a. Sandy loam topsoil, well drained homogeneous texture and of uniform grade, without the admixture of subsoil material. Topsoil shall be entirely free of dense material, hardpan, clay, stones over 3/4" in diameter, sod, or any other objectionable foreign material, including but not limited to, glass, debris, toxins, hazardous wastes and chemicals (such as atrizene or muriatic acid within the past seven (7) years) that may be injurious to humans, animals and plant materials.

b. Organic Matter: Containing not less than 5% or more than 10% organic matter in that portion of a sample passing a 1/4" sieve when determined by the wet combustion method on a sample dried at 105 degrees F.

2. pH Value: Containing a pH value within the range of 6.0 to 7.0 on that portion of the sample which passes a 1/4" sieve.

3. Soluble salt content: Not higher than 500 parts per million.

4. Sieve Analysis for general lawn work: Shall be screened or rock picked to meet the following gradation:

Sieve Designation	% Passing
3/4"	100
1/4"	97-100
No. 200	20-65 (of the 1/4" sieve)

5. Sieve Analysis for Athletic Field lawn work: Shall be mechanically screened by an onsite screening facility provided by the Contractor prior to placing and spreading. Athletic field topsoil shall meet the above sieve requirements.

C. No lawn shall be seeded or sodded on topsoil that has been chemically treated until sufficient time has elapsed to permit dissipation of all toxic materials. The Contractor shall assume full responsibility for any loss or damage to turfgrass sod or the inability to grow a sufficient stand of grass from seed, as indicated herein, arising from improper use of chemicals or due to failure to allow sufficient time to permit dissipation of toxic residues, whether or not such materials are specified herein.

2.02 LAWN SEED MIX

A. Provide fresh, clean, new-crop seed mixed in the proportions specified for species and variety, and conforming to Federal, State, latest American Association of Nurseryman (AAN) Standards and National Turf Evaluation Program (NTEP).

B. Acceptable material in a seed mixture other than pure live seed consists of nonviable seed, chaff, hulls, live seed of crop plants and inert matter. The percentage of weed seed shall not exceed 0.05% by weight.

C. All seed must by fresh seed. Seed that is left over from the previous year and beyond sell by date is not acceptable.

D. Grass seed shall be certified "Blue Tag" seed composed of a blend of varieties mixed in proportion by weight and tested for minimum percentages of purity and germination. Submit the proposed mixture to the Architect for approval.

E. Provide the following lawn seed mix:

Amount by Weight	Species or Variety	Percentage Purity	Germination
40% (Min.)	Kentucky Bluegrass Blend*	95%	85%
35% (Max.)	Fine Textured Endophytic Perennial Rye**	98%	90%
25% (Min.)	Creeping Red Fescue***	97%	85%
100%			

* Kentucky Bluegrass Blend shall contain no more than 25% of any one cultivar and always at least two (2) different cultivars. Acceptable cultivars: Rambo, Princeton-105, Wildwood, Allure, Coventry, Champagne, Northstar, Cardiff, Nimbus, Raven, SR2100, Misty, America, Brilliant, Limousine, Conni, Liberator, Apollo, NuGlade, Total, Eclipse, Unique, Impact, Midnight, Arcadia, and Serene or Architect approved equal.

** Perennial Rye Blend shall contain no more 30% of any one (1) cultivar and always at least three (3) different cultivars. Acceptable cultivars: Palmer III, Calypso II, Brightstar II, Secretariat, Monterey, Catalina, Pennant II, Premier II, Sonata, Sunshine and Ascend or Architect approved equal.

*** SR5000 is acceptable.

F. Acceptable Seed Suppliers:

United Agri Products
Steve Hyde (315) 383-5035;

Matrix Turf Solutions
Jerry Clark (315) 480-7340;

Lesco, Inc.
Will Abel (315) 437-3423;

Preferred Seed
Jack Bryant (716) 895-7333;

Or Architect approved equal.

2.03 COMMERCIAL GROWN SOD

A. Sod shall conform to NYSDOT Item 713-14 and be approved nursery grown mineral soil sod with majority Kentucky Bluegrass and minority Tall Fescue blend. Muck grown sod is NOT acceptable. Sod pads with plastic netting is NOT acceptable.

B. Provide well-rooted, healthy sod, free of diseases, nematodes and soil borne insects. Provide sod uniform in color, leaf texture, density, and free of weeds, undesirable grasses, stones, roots, thatch and extraneous material viable and capable of growth and development when planted. Sod is considered free of weeds when less than five (5) weeds are found per one hundred (100 s.f.) square feet.

C. Thickness of Cut: Furnish sod machine cut at a uniform soil thickness of 0.60 inch at the time of cutting and of supplier's standard width, length, and thickness: uniformly 1" to 1-1/2" thick with clean cut edges. Measurement of thickness shall exclude top growth and thatch. Mow sod before stripping.

D. Mowing Height: Before stripping, sod shall be mowed uniformly at a height of 1 to 1-1/2 inches.

E. Thatch: Sod shall be relatively free of thatch, up to 1/2 inch allowable (un-compressed).

F. Pad Size:

1. Individual pieces of sod shall be cut to the supplier's standard width and length. Maximum allowable deviation from standard widths and lengths shall be plus or

minus 1/2 inch on width and plus or minus 5% on length. Broken pads and torn or uneven ends will not be acceptable.

G. Strength of Sod Sections: Standard size sections of sod shall be strong enough to support their own weight and retain their size and shape when suspended vertically from a firm grasp on the upper 10% of the section.

H. Standard of Quality: Shall be Premium Sod supplied by Batavia Turf (800) 333-1472, Sky High Turf Farms (315) 687-6510, Saratoga Sod Farm (518) 664-5038, Lakeside Sod (716) 741-2877 or Architect approved equal.

2.04 LIMESTONE

A. Shall be ground limestone in the producer's standard bags containing not less than 85% total carbonates and conforming to the following gradations:

Sieve Designation	% Passing
No. 100	50-100
No. 20	100

B. The lime shall be uniform in composition, dry and free flowing and shall be delivered to the site in the original, unopened containers, each bearing the manufacturer's guaranteed analysis. Any lime which becomes caked or otherwise damaged making it unsuitable for use will be rejected.

2.05 TACKIFIER FOR SEEDED LAWNS

A. Shall be liquid concentrate diluted with drinkable water forming a transparent three-dimensional film-like crust permeable to water and air, containing no agent’s toxic to seed germination to hold straw mulch in place.

B. Standard of quality shall be Terra Tack or Architect approved equal.

2.06 FERTILIZER

A. For Starter Fertilization: Immediately prior to seeding, fertilize with a commercial starter fertilizer, granular, non-burning product, with not less than 90% organic slow acting, micro nutrients and 1% iron, guaranteed analysis commercial fertilizer. Fertilizer ratio shall be: (1-2-1). Apply at a rate of 0.33 - 0.66 lbs of nitrogen (N) per 1,000 sf.

B. For Subsequent and Final Fertilizations: Apply commercial fertilizer, poly coated granular non-burning product with not less than 90% organic slow acting, guaranteed analysis

1. For Spring and Fall Lawn Work: Fertilizer ratio shall be: (3-0-1). Apply at rate of 1.5 - 2 lbs nitrogen (N)/1,000 s.f.

2.07 MULCH FOR SEEDED LAWNS

A. Dry Application Straw: Shall be straw consisting of clean stalks of oats, wheat, rye or other approved crops well seasoned before baling which are free of noxious weed seeds and roots. Weight shall be based on 15% moisture.

B. Hydro Applications: Shall be hydro mulch containing 100% wood fiber mulch. Standard of quality shall be Mat Fiber as manufactured by Mat, Inc. and distributed by Matrix Turf Solutions, (315) 468-6000 or Architect approved equal.

2.08 WATER: Free of substance harmful to lawn, other plants, humans and animals.

PART 3 - EXECUTION

3.01 INSPECTION

A. Verify limits of lawn work, lawn types, lawn restoration areas and contract limits. Notify the Architect of discrepancies prior to proceeding with lawn work.

B. Examine finish surfaces, grade, topsoil quality, plant beds, and site access.

C. Do not start lawn work until unsatisfactory conditions are corrected to the satisfaction of the Architect.

3.02 SPREAD TOPSOIL

A. Limit preparation to areas which will be immediately seeded.

B. Perform topsoil spreading operations only during dry weather.

C. To ensure a proper bond with the topsoil, disc, harrow, or otherwise scarify and loosen the lawn subgrade to a depth of four (4") inches before spreading topsoil.

D. Spread topsoil to ensure a minimum settled depth of four (4") inches in lawn areas.

3.03 PREPARE GENERAL LAWN AREAS

A. Perform a pH test, sieve, and nutrient analysis of the topsoil and advise the results to the Architect prior to adding limestone or other soil amendments. Soil amendments shall be uniformly incorporated into the top four (4") inches of topsoil by discing, harrowing or other approved methods.

B. Remove debris and stones 3/4" or larger by handpicking, fine tooth aluminum grading rakes, and mechanized stone picker. When topsoil has hardened, cultivate soil to a four-inch, (4") depth by plowing, discing, harrowing, or otherwise scarifying and loosening the topsoil.

C. Grade lawn areas to a smooth, free draining even surface with a loose, moderately coarse texture. Scarify, rake, level, and roll with a light static roller as necessary to obtain true, even lawn surfaces and fill depressions as required to drain. Correct irregularities in the surface resulting from tillage operations to prevent formation of depressions or water pockets.

D. Cultivate soil to provide a firm bed of minimum of four (4") inches deep, free of clods, stones, or foreign matter over 3/4" in diameter from the top of soil. Do not move heavy objects except necessary lawn making equipment over the lawn areas after the soil is prepared unless it is again loosened and graded. Remove stones and all debris greater than one 3/4" in diameter during cultivation. Level undulations and irregularities in the surface.

E. For pH correction provide adjusted rate of application as recommended in Topsoil Test Report submittal. For low pH correction: Add ground limestone at the rate indicated by the soil test. For high pH correction: Materials and application rates shall be determined by appropriate soil tests.

F. Place starter fertilizer at the rate of 0.33 - 0.66 lbs. of nitrogen (N) per 1,000 sf. and mix into full depth of topsoil.

G. Rake area with fine toothed aluminum grading rake before placing seed to obtain a smooth surface at the proper elevation. Drag area with a wood float to level out minor humps and hollows. Beds shall have a smooth friable uniform surface, free of areas ponding water.

H. Notify Architect when seed bed is ready for review as specified in Job Conditions. Obtain Architect's approval of finish grade prior to seeding.

I. Seed lawns immediately after preparation of bed and Architect's approval.

J. For Seeded Lawn:

1. Seed at the rate of 6 lbs. per 1,000 S.F.

2. Seeding shall be performed as follows: ½ rate and mechanically incorporated into the top ½" of topsoil. The remaining ½ rate shall be mechanically spread at 90 degrees to the first application and lightly rolled.

3.04 SODDING

A. Moistening the Soil: During periods of higher than optimal temperature for species being specified and after unevenness in the soil surface has been corrected, the soil shall be lightly moistened immediately prior to laying the sod.

B. Lay sod to form a solid mass with tightly-fitted joints in strips parallel to contours. Butt ends and sides of sod strips. Do not overlap edges. Stagger strips to offset joints in adjacent courses. Remove excess sod to avoid smothering of adjacent grass. Provide sod pad top flush with finish grade of adjacent curbs, pavements, drainage structures and seeded areas.

C. Do not lay dormant sod or install sod on soil surfaces that are hot, dry, saturated or frozen.

D. Roll with light static lawn roller to ensure contact with subgrade.

E. Water sod thoroughly to a depth sufficient to ensure the underside of the new sod pad and topsoil immediately below the pad is thoroughly wet. Contractor is responsible to ensure there is an adequate water supply available prior to installation. Do not allow sod to dry out.

3.05 MULCHING SEEDED AREAS

A. Mulch immediately after seeding.

B. Dry Mulch Application: Place mulch by hand or by machine at a rate of one bale/1,000 s.f. to produce a light even mulch cover so that 50% of soil is visible through the mulch layer.

C. Hydro Application: Place hydromulch by machine at a rate of one bale/1,000 sq. ft. to produce a light even mulch cover so that 50% of soil is visible through the mulch layer. NOTE: Seeding with a hydroseeder is NOT acceptable.

D. Anchor mulch by thorough heavy coat of tackifier over entire area and watering.

E. Protect seed bed from washout, wind erosion, rutting and drying out. Do not use machinery that leaves ruts in the seed bed. It is the Contractor's responsibility to add or remove mulch as needed to encourage optimum seed germination and growth.

3.06 MAINTENANCE

A. Maintenance by Contractor begins as soon as lawns are seeded. Protect lawns from drought, washout and wind erosion. In general, maintain new installed lawn areas, including watering, fertilizing, core aerating, spot weeding, overseeding, mowing, applications of herbicides, fungicides, insecticides, until a full, uniform, healthy, vigorous stand of grass free of weed, undesirable grass species, disease, and insects is achieved and accepted by the Architect. Specifically:

1. Watering Seeded Lawns:

a. First Week: In the absence of adequate rainfall, watering shall be performed daily or as often as necessary during the first week to maintain moist soil to promptly germinate the lawn seed, preventing it from drying out, and keeping it in a healthy, growing condition until final acceptance. Lawn areas shall receive a minimum of one (1") of water per week, by natural rainfall, irrigation or a combination of both. Water daily until 2nd mowing (just enough water to keep the top ½" of soil moist, 1 time daily).

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3. Second and Subsequent Weeks: Contractor shall provide water to the lawns as required to maintain adequate moisture, in the upper four (4") inches of soil, necessary for the promotion of deep root growth until final acceptance. After 2nd mowing, water two (2) times weekly until thoroughly established.

4. Protect: Protect lawn areas against trespass, vandalism and routine pedestrian traffic and Owner maintenance traffic by temporary fencing or other means.

5. Repair: Repair, rework, resod and overseed (as originally specified for that area) areas that have washed out, eroded, do not germinate and are vandalized or otherwise damaged. Overseeding rates are to be adjusted to 6 lbs. of seed per 1,000 s.f.

6. Mow: Initial mowing shall begin when the blade height reaches 2" and the soil will bear the weight of the lawn mower. Use mowers with low impact tires. For the first 3 mowings cut the grass blades to 1.5 inches. After that mow the grass when it reaches a height of about 3.5" to a height of about 2.5". Never remove more than 1/3 of the grass blade at any one mowing**. A minimum of FIVE, (5) mowings are required (approximately once per week after the initial germination period to final acceptance).** Notify the Architect of dates in writing as mowing is performed. Excess clippings shall be carefully raked so as not to remove healthy grasses and removed.

7. Fertilizer: Immediately after core aerating, between mowings three (3) and four(4), apply subsequent fertilizer at the rate of 1.5-2 lbs./1,000 s.f. Provide additional fertilizer as directed by the Architect to expedite the lawn maturation process.

8. Weed Control: When infestation of weeds or crabgrass develops, treat infestation by hand weeding or herbicides control appropriate to the area. Furnish and install weed chemical control as recommended by manufacturer. Herbicides controls must be acceptable to the Owner. Obtain and pay for permits. Use as directed by the manufacturer and applicable laws, codes, ordinances and regulatory requirements. Under NO circumstances is it acceptable to seed or overseed over Nutsedge, Crabgrass or other grassy/broadleaf weeds.

B. Maintenance by the Contractor continues through the certificate of substantial completion to final acceptance by the Architect as described below. Maintenance by Owner begins after final acceptance of the lawn.

3.07 STANDARDS FOR SUBSTANTIAL COMPLETION OF LAWNS: Review to determine substantial completion of lawns will be made by the Architect, upon request. Provide notification at least five (5) working days before requested review date.

A. Lawn areas will be substantially complete provided requirements, including maintenance, have been complied with. A healthy, vigorous, uniform, partially mature stand of lawn is established free of weeds, undesirable grass species, disease, and insects. With proper watering and maintenance as indicated herein, this should culminate after an approximate 60-day period for initial germination with average temperatures above 40°F. Grass roots shall have matured to a minimum of 1½" depth as determined by the Architect when core samples are taken.

B. Lawn areas shall not have more than 10% dead/bare spots.

C. Contractor shall provide a written copy of all maintenance activities performed up to this date.

D. The architect will prepare a written punch list of items which need correction prior to final acceptance.

3.08 STANDARDS FOR FINAL ACCEPTANCE OF LAWNS: Review to determine final acceptance of lawns will be made by the Architect, upon request. Provide notification at least five (5) working days before requested review date.

A. Lawn areas will be acceptable provided requirements, including maintenance, have been complied with. A healthy, vigorous, uniform, full stand of lawn is established free of weeds, undesirable grass species, disease, and insects. Grass roots shall have matured to a minimum of 2" depth as determined by the Architect when core samples are taken.

B. Any lawn which contains disease, more than 1% dead/bare spots, or any dead/bare area greater than one (1) square foot shall be rejected and the unacceptable area(s) repaired as originally specified at no additional cost to the Owner.

C. In the event the Contractor fails to complete the punch list items within a 30-day period with average temperatures of 40°F after the time of Substantial Completion, the Contractor shall be liable to the Owner for any additional costs including those charged by the Architect.

D. Contractor shall provide a written copy of all maintenance activities performed during the contract up to final acceptance of lawns.

3.09 CLEAN UP

A. Sweep Pavements of excess straw mulch. Remove irrigation equipment, hoses, or sprinklers.

B. During the contract and at intervals as directed by the Architect and as lawn work is completed, clear the site of extraneous materials, rubbish, and debris. Leave the site in a clean, safe, neat, well-draining condition.

END OF SECTION 32 92 01

SECTION 33 30 00
SITE SANITARY

PART 1 - GENERAL

1.01 DESCRIPTION OF WORK

A. The extent of Site Sanitary work is shown on the drawings.

B. Sanitary work includes, but is not limited to:

1. Sanitary Manholes
2. Concrete manhole adaptors
3. Trenching and Backfilling
4. Piping and jointing to five feet from exterior building face
5. Connections to existing sanitary systems
6. Clean-outs
7. Concrete cradles, saddles and collars (if required)
8. Clean Up

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C. Provide materials, labor, equipment and services required to accomplish related work in accordance with the drawings and specifications.

1.02 RELATED WORK SPECIFIED ELSEWHERE

A. Section 321301 - Site Concrete Work

B. Section 334001 - Storm Drainage

1.03 SUBMITTALS: (See Section 311201, 1.5)

A. Provide Manufacturer's Product Data (MPD) and Shop Drawings for:

1. Precast Structure (Manholes, castings): Also, certification that structures meet H-20 loading requirements specified.
2. Pipe and jointing MPD only
3. Clean-out MPD only
4. Concrete manhole adaptors

B. Provide Material Certificates: Also, samples as noted.

1. Granular Backfill: Sample
2. 4000 psi concrete

C. Provide Permits, Test Results, Certifications and Operator's Manuals as noted below:

1. Permit and Notification Letter: Copy of each as required in 1.04 B and C, also 3.1 B below.
2. Certification: As required in 1.04 E and 3.12 below.

1.04 JOB CONDITIONS

A. Job conditions in Section 334001 – Storm Drainage apply.

B. Sewer work shall conform to standards of applicable government authorities having jurisdiction. Obtain and pay for permits and approvals required by local authorities. Copy permits to Architect.

C. Notify City Engineer/ Utica DPW or applicable government authority having authority in writing two (2 wks.) weeks prior to start of work. Copy letter to Architect.

D. Certification: The sanitary system must be installed and certified by a licensed county Plumber when required by municipal or state law.

E. Construction Review: Notify the Architect when the sanitary sewer system is approximately 25%, 75% and 95% complete.

PART 2 - PRODUCTS

2.01 SANITARY MANHOLE

A. Shall conform to Section 334001 - 2.2, A., 2.3, 2.5, and 2.6.

B. Manhole frames and covers shall be Syracuse Casting Sales Corp. Pattern 1030, Neenah Foundry Co. R-1642 with Type "A" lid of Architect approved equal. Lid shall have raised lettering on the cover to designate "SANITARY SEWER". Frames and covers shall be machined to prohibit rocking.

C. Pipes entering manhole shall have concrete manhole adaptors as manufactured by (CMA) FERNCO or Architect approved equal.

2.02 GRANULAR BACKFILL

A. Backfill for piping and sanitary structures shall be as specified in Section 312201, 2.1, B.

B. Backfill for Absorption Trenches shall be washed, graded, angular gravel, free of shale, clay, friable materials and debris, sized 3/4 to 1-1/2 inches.

2.03 PIPING

A. P.V.C. Gravity Sewer Pipe shall conform to ASTM D-3034, SDR 35. Joints shall be rubber flexible gasketed joints conforming to the ASTM F477.

Or

B. Ductile iron pipe for four (4") inch internal diameter shall be Class 51 and for six (6") inch and larger internal diameter shall be Class 50 conforming to ANSI/AWWA C151/A21.51. Mechanical joint bells, glands, bolts, gaskets shall have a working pressure of 350 psi and shall be in conformance with ANSI/AWWWA C153/A21.53. Pipe fittings shall be coated inside and out with coal tar varnish in conformance with ANSI/AWWWA C153/A21.53.

2.04 CLEAN-OUT

A. Shall be 4-inch ductile iron soil pipe with secured cap and “Y” branch fitting to the sewer lateral. Provide a 45-degree bend below the riser conforming to City of Utica DPW, and/or applicable plumbing code.

B. Provide 10-inch cast-iron frame and cover, with “SEWER” designation on cover. East Jordan Irion Works model #3648 or approved equal.

PART 3 - EXECUTION

3.01 CONNECTIONS TO OTHER SANITARY SYSTEMS

A. Connections at Building(s):

1. Locate accurately per site and plumbing drawings. Verify inverts and sizes. Notify Architect of any discrepancies immediately, prior to installation.
2. Install pipe and jointing to five (5') feet from the exterior building face.
3. Cap end and mark.
4. The Plumbing Contractor will make connection.

B. Connections to existing Sanitary Systems:

1. Locate accurately per drawings. Verify inverts and sizes. Notify Architect of any discrepancies immediately, prior to installation. Coordinate with the Municipality and other agencies having authority. Obtain require permit(s).
2. Notify governing agency in writing a minimum of two (2 weeks) weeks prior to anticipated date of connection. Copy letter to Architect.
3. Connect the site sanitary system to the laterals or manholes as indicated.
4. Connect lateral lines into main with approved, water-tight duplex adaptor and 45-degree bend to the sewer main.
5. TEE lateral Connection to sewer main: Geneco T-wye saddle with stainless steel t-bolts and stainless-steel swivel pins, strap and nuts.
6. Manhole connections shall be made with approved concrete manhole adaptors.
7. Pipe sleeves shall be 2 pipe sizes larger than the specified pipe diameter.

3.02 TRENCHING AND BACKFILL

Shall be as described in Section 334001, 3.2.

3.03 MASONRY

Shall be as described in Section 334001, 3.3.

3.04 CASTINGS

Shall be as described in Section 334001, 3.4.

3.05 PIPE LAYING

A. Bed pipe in granular backfill or concrete as shown on drawings, compact under spring line of pipe to assure firm support. Align pipe to line and grade given in plan and profile. Set batter boards or set by laser level.

B. Place backfill around pipes to equal depths on both sides as work progresses. Compact trenches to at least ninety-five (95%) percent maximum density as specified in Section 312201.

C. P.V.C. pipe push type joints shall be made using the flexible gaskets specified. Push together pipes so that the gasket is firmly seated in the socket.

D. Ductile iron mechanical joints shall be securely tightened with gasket firmly seated to create a watertight joint.

E. "Lamp" pipes to check for misalignment and breakage after backfilling has been completed. Replace pipes deviating more than 1/2" from line or grade at no additional cost to the Owner.

F. Concrete cradles, saddles and collars: Refer to Section 321301, Part 3.

G. Conduct testing as described in 1.6 above.

3.06 CLEAN-OUT

A. Cleanouts shall be located at a maximum distance of 100-feet from building or manhole. Verify location(s) with Municipal City Engineer/ DPW prior to installation. Install as detailed.

B. Set cleanout frame and cover flush with finish grade. Provide concrete collar around cleanouts located in lawns as detailed.

3.07 PROVIDE CERTIFICATION

A. Provide written certification from the Municipal Engineer that the sanitary work in the public right of way has been installed in a manner satisfactory to the governing agency having authority over the work. Provide certification prior to Architect issuing final acceptance.

B. Patch road cuts, sidewalks, lawns or other surfaces in accordance with City DPW standards.

C. Provide record survey of finished sewer work.

3.08 CLEAN UP

During the contract and at intervals as directed by the Architect and as the sanitary sewer system is completed, clear the site of pipe, trench and backfill material, stone, concrete and debris. Leave the site in a clean, safe, well draining, and neat condition.

END OF SECTION 33 30 00

SECTION 33 40 01
STORM DRAINAGE

PART 1 - GENERAL

1.01 DESCRIPTION OF WORK

A. The extent of the storm drainage is shown on the drawings.

B. Storm drainage work includes, but is not limited to:

1. Trenching, backfilling and compaction
2. Storm structures, castings, and appurtenances
3. Piping, jointing and fittings
4. Connection(s) to other storm system(s)
5. Adjusting existing storm structures and other utilities
6. Storm Water Management Trench (SMT)
7. Storm Water Retention Structure(s)
8. Pipe sleeve and waterproof seals
9. Quality Control Testing and Submittals
10. Clean Up

C. Provide materials, labor, equipment and services required to accomplish related work in accordance with the drawings and specifications.

1.02 RELATED WORK SPECIFIED ELSEWHERE

A. Section 311201 - Site Preparation

B. Section 312501 - Erosion, Sediment and Pollution Control

C. Section 312201 - Site Earthwork: For Elaboration of Shoring and Bracing, Dewatering, Backfilling, Compaction and Field Quality Control Testing.

1.03 REFERENCES

A. ASTM D2321 Standard Practice for Underground Installation of Thermoplastic Pipe for Sewer and Other Gravity Flow Applications.

1.04 SUBMITTALS: (See Section 311201, 1.5)

A. Shop Drawings (SD) required for:

1. Precast concrete drainage structures showing sizes, elevations for openings and, HS20 loading certification.
2. Storm Water Retention Structures

B. Manufacturer's Product Data (MPD) required for:

1. Drainage structures and castings
2. Pipe, joints and fittings
3. Stormwater Management Trench for Pipes and Geotextiles

C. Material Certificates (MC) showing mechanical analysis and samples required for:

1. Stormwater management trench drainage stone

D. Quality Control Submittals:

1. Provide a list of completed projects including Owner's contact information for each project, demonstrating compliance with applicable "Experience Requirements" specified in "Quality Assurance" of this specification section.

2. Provide Infiltration Testing Report(s) for bio-retention areas as described in "Quality Assurance" of this specification section. Stormwater facility design may be adjusted by Architect depending on results of tests.

1.05 QUALITY ASSURANCE

A. Drainage Contractor Experience Requirements:

1. Submit business name, business owner(s) name(s), business address, telephone number, website and/or email address signed by the Contractor/Subcontractor who meets the qualifications set forth in this specification and is proposed by the Contractor to perform the Drainage for this Project.

2. Provide a list of at least four (4) Drainage work projects of comparable size, scope and quality completed successfully by the proposed Contractor/Subcontractor within the past three (3) years that includes the date completed, project Owner's name and current contact information, including telephone numbers and email addresses.

B. Infiltration Testing Required by Contractor: (Subsurface Storage System)

1. Perform two (2) infiltration tests in locations as directed by the Architect and as detailed.

2. May be done through a boring or open excavation as described in NYSDEC, Division of Water, published in Standards of Wastewater Treatment Works, 1988 or latest revision.

3. Install casing (solid 4-6 inch diameter, 30" length) to 24" below finished grade.

4. Remove any solid surface and provide a natural soil interface into which water may percolate. Remove all loose material from the casing. Upon the tester's discretion, a two (2") inch layer of coarse sand or fine gravel may be placed to protect the bottom from scouring and sediment. Fill casing with *clean* water to a depth of 24" and allow to pre-soak for twenty-four hours.

5. Twenty-four hours later, refill casing with another 24" of clean water and monitor water level (measured drop from the top of the casing) for 1 hour. Repeat this procedure (filling the casing each time) three additional times, for a total of four observations. Upon tester's discretion, the final field rate may either be the average of the four observations, or the value of the last observation. The final rate shall be reported in *inches per hour*.

6. Upon completion of the testing, the casing shall be immediately pulled, and the test pit shall be backfilled and site restored.

1.06 JOB CONDITIONS

A. Job conditions in Section 312201 apply.

B. No overnight open excavation is permitted.

C. CERTIFICATION OF STORM SYSTEM: The storm system must be installed and certified by a licensed County Plumber when required by municipal code or state law.

D. CONSTRUCTION REVIEW: Notify the Architect when the storm system is approximately 25%, 50% and 95% complete.

1.07 SUBSTITUTIONS

A. Contractor is responsible for design of any substituted structures, systems or units in Section 334001 by a NYS licensed engineer. Submit to Architect for approval.

B. If a product is being submitted as a substitution to the specified product; the the Prime Contractor shall submit and request a product material substitution with his/her bid. The Prime Contractor shall at a minimum provide the following for review by the Architect and Owner:

1. All submittals as specified herein

2. Product comparison

3. Cost Information (including proposal of change in Contract Sum)

4. Contractor's certification that proposed substitution complies with requirements in the Contract Documents

5. Contractor's waiver of rights to additional payment or time that may subsequently become necessary because of failure of proposed substitution to produce indicated results.

PART 2 - PRODUCTS

2.01 BACKFILL

A. Backfill for pipes, Stormwater Management Trenches (SMT), and drainage structures shall be as specified in Section 312201.

2.02 STORM STRUCTURES AND CASTINGS

A. Storm Inlets and Manholes:

1. Shall be precast reinforced portland cement concrete conforming to the size(s) and shape shown on drawings, designed for AASHTO HS-20 loading. The materials and structural design of the structures shall be per ASTM C478 and ASTM A497, Grade 60. The minimum compressive strength of the concrete in the structure base, riser, and top section shall be 5,000 psi. The minimum wall thickness shall be one twelfth of the internal diameter of the riser or largest cone diameter. All joints shall be waterproofed with O-ring rubber gaskets and sealed with a mastic treatment in accordance with ASTM C990. Any grout used within the system shall meet the ASTM C 1107. Manhole connector holes shall be equipped with a seal gasket that meets or exceeds material specification of ASTM C-923 or other locally approved methods. Base units shall be extended.

Standard of quality shall be as manufactured by Zeiser Wilbert, Jefferson Concrete, Fort Miller or Architect approved equal.

2. Castings: Provide HS20 loading and bike safe grates, ductile iron meeting grade 65-45-12 as determined by ASTM A536-84, sizes as noted on the plans. Frames, covers and grates shall be machined to prohibit rocking. Standard of Quality shall be Neenah Foundry, East Jordan Iron Works, US Foundry, or Architect approved equal.

2.03 STORM STRUCTURE APPURTENANCES

A. Precast Concrete Adjustment Rings: Shall be square or round depending on structure. Built in accordance to ASTM C478, and made of 5,000 psi concrete and reinforced steel, meeting ASTM A615 Grade 60, as manufactured by Fort Miller, Zeiser Wilbert, Jefferson Concrete or Architect approved equal.

B. Steps: Shall be copolymer polypropylene plastic reinforced with 1/2" diameter grade 60 steel as manufactured by M.A. Industries or Architect approved equal.

C. Mortar: Shall be lime, cement, and clean sand, 1:1:3 measured by volume, meeting ASTM C1107.

D. Coal Tar Sealer: Shall be used to coat the inside and outside of installed precast risers. Standard of quality shall be Hydralastic 836 as manufactured by W. R. Meadows, (800) 342-5976 or Architect approved equal.

2.04 PIPING

A. High Density Polyethylene Pipe (HDPE): Shall be heavy duty dual wall, high density polyethylene (HDPE) pipe conforming to ASTM F2648 for 4" to 60" pipe with a smooth inner wall, annular corrugations, "n" flow rating of 0.012, and HS-20 loading capability with minimum one (1') foot cover for 4" to 48" pipe and two (2') foot cover for 6-" pipe. Joint couplings for pipe shall be connected using a bell &spigot joint, meeting AASHTO M252, AASHTO M294, or ASTM F2306. The joint shall be soil tight and gaskets, when applicable, shall meet the requirements of ASTM F477. Standard of quality shall be N-12 Mega Green ST IB pipe as manufactured by Advanced Drainage Systems, Inc., 800-821 6710, or Architect approved equal.

B. Polyvinyl Chloride (PVC) Pipe: Shall be rigid, solid (non-perforated) P.V.C. Gravity Sewer Pipe conforming to ASTM D-3034, SDR 35 for pipes 4" to 15" diameter and ASTM F679 for pipes to 24" diameter with rubber gasketed joints conforming to ASTM F477.

2.05 STORM WATER MANAGEMENT TRENCH

A. 4" to 10" Pipe: Shall be flexible, heavy duty, corrugated interior and exterior, perforated (or slotted) polyethylene pipe meeting requirements ASTM F-667 for 4" to 10" diameters. Standard of quality shall be ADS with prefabricated snap fittings as manufactured by Advanced Drainage Systems, Inc., (614) 457-3051 or Architect approved equal. Size pipe(s) as noted on drawings.

B. 12" to 24" Pipe and Fittings: Shall be heavy duty polyethylene (HDPE), corrugated interior and exterior, perforated pipe meeting requirements AASHTO M252, AASHTO M294, Type C. Standard of quality shall be ADS with prefabricated fittings as manufactured by Advanced Drainage Systems, Inc., (614) 457-3051 or Architect approved equal. Size pipe(s) as noted on drawings.

C. 4" to 12" Fittings: Shall be injection molded fittings with a smooth interior and exterior meeting requirements AASHTO M252 for 4" to 10" diameters, and ASTM M294 or ASTM F2306 for 12" diameter. Standard of quality as manufactured by Advanced Drainage Systems, Inc., (614) 457-3051 or Architect approved equal. Size pipe(s) as noted on drawings.

D. Backfill: Shall be clean, washed No. 1 stone as indicated in Section 312201.

E. Soil Separation Fabric: Shall be a commercially manufactured non- woven polypropylene filter fabric. Standard of quality shall be Mirafi 140N as manufactured by TenCate or Architect approved equal.

2.06 STORM WATER RETENTION STRUCTURES

A. Chamber Design:

1. Only stormwater chamber systems evaluated by a NYS licensed design engineer and found to meet AASHTO section 12.12 safety factors will be considered.

2. Stormwater chambers shall be designed in accordance with ASTM F 2418-16a or F 2922 Standard Specification for Polypropylene (PP) or Polyethylene (PE) Corrugated Wall Stormwater Collection Chambers

3. The structural design of the chambers, the structural backfill, and the installation requirements shall ensure that the load factors specified in the AASHTO LFRD bridge design specifications, section 12.12, are met for: 1) Long-duration dead loads and 2) Short-duration live loads, based on the AASHTO design truck with consideration for impact and multiple vehicle presences.

4. Stormwater chambers shall be designed, tested and allowable load configurations determined in accordance with ASTM F 2787, “Standard Practice for Structural Design of Thermoplastic Corrugated Wall Stormwater Collection Chambers”. Load configurations shall include: 1) Instantaneous (<1 min) AASHTO design truck live load on minimum cover 2) Maximum permanent (75-yr) cover load and 3) Allowable cover with parked (1-week) AASHTO design truck.

5. Stormwater water retention structures standard of quality shall be **StormTech SC-740,** as manufactured by Advanced Drainage Systems, Inc., (614) 457-3051 or Architect approved equal.

B. Performance:

1. Upon request by the Architect or Owner, the chamber manufacturer shall submit a structural evaluation for approval before delivering chambers to the project site as follows:

   a. The structural evaluation shall be sealed by a NYS licensed professional engineer.
   b. The structural evaluation shall demonstrate that the safety factors are greater than or equal to 1.95 for dead load and 1.75 for live load, the minimum required by ASTM F 2787 and by sections 3 and 12.12 of the AASHTO LFRD bridge design specifications for thermoplastic pipe.

c. The test derived creep modulus as specified in ASTM F 2922 shall be used for permanent dead load design except that it shall be the 75-year modulus used for design.

3. Only mechanical and material properties that were determined in accordance with ASTM test methods shall be allowed for structural design of the chambers.

4. Only chambers affixed with the ASTM F 2418-16a or F 2922 designation shall be considered as meeting ASTM F 2418-16a or F 2922.

5. The contractor shall submit design summary by the manufacturer that demonstrates that the system is designed to convey peak flow rates without scour of foundation stone.

C. Materials:

1. Chamber:

a. Chambers shall be arch-shaped and shall be manufactured from virgin, impact-modified polypropylene or polyethylene copolymers.
b. Chamber rows shall provide continuous, unobstructed internal space with no internal support panels in order to provide ease of access for inspection and maintenance functions.
c. Inspection ports shall be installed and constructed per project plans. Note that inspection ports shall only be installed along the Treatment Row to allow for inspection of the sediment build up over time.
d. The chambers shall be open-bottomed.
e. The chamber shall incorporate an overlapping corrugation joint system to allow chamber rows of almost any length to be built. Chamber models may be cut at the job site to improve site optimization and reduce product waste.

2. Chambers and end caps shall be produced at an ISO 9001 certified manufacturing facility.

3. End Caps:

a. End caps shall be injection molded or roto molded from polyethylene or polypropylene resin and allow pipe connections with polyethylene pipe. End caps shall have a curved face capable of resisting typical horizontal and vertical loads.
b. All chamber rows shall be terminated with an end cap. End cap placement on end of chamber will vary depending on chamber model.
c. End caps may incorporate cutting guides to allow easy field cutting for various diameters of pipe. Cutting guides shall be located at both the top and bottom of each end cap.

4. Manifold Piping:

a. Manifold piping shall be designed to ensure that peak flows are distributed to the rows of chambers without scour of foundation stone.
b. Manifold piping shall be of dual wall HDPE piping such that accepted equations of hydraulics can be used as a basis for design.

5. Stone:

a. The foundation, embedment and cover stone shall be in accordance with the chamber manufacturer's installation instructions.

b. Foundation and Backfill for "SC" chambers shall be clean, crushed, angular stone meeting the following gradation as determined by ASTM-C136 and AASHTO M145:

Standard Sieve Sizes	Percent Passing By Weight
2" or 50 mm	100%
1" or 25 mm	95 - 100%
1/2" or 12.5 mm	25 - 60%
#4 or 4.75 mm	0 - 10%

6. Fabric:

a. Fabric between the chamber bottom and the stone foundation located along the entire length of the Treatment Row and the first 14.5 ft of all inlet rows.
b. Fabric shall be Mirafi 500X as manufactured by TenCate or Architect approved equal for sediment capture, filtration and scour protection.
c. Fabric between the top of the Treatment Row chambers and the embedment stone and surrounding the entire chamber system shall be Mirafi 140N as manufactured by TenCate or Architect approved equal for filtration.
d. If shown and labeled on the drawings, a non-reinforced 30 mil PVC liner with solvent welded seams will be installed around the entire system to prevent water migration. See manufacturer's Tech Sheet #2 for guidance on PVC liners for the system.

D. Stormwater Treatment Row:

1. The stormwater chamber system shall incorporate an Treatment Row for stormwater treatment and system maintenance. An Treatment Row is a chamber row enclosed in geotextile fabric for sediment capture and maintenance.

2. The Treatment Row shall remove a minimum of 80% of Total Suspended Solids (TSS), 80% Total Petroleum Hydrocarbons (TPH), 80% Suspended Sediment Concentration, 60% Total Phosphorus, and 605 Total Zinc as verified by 3rd party testing.

3. Stormwater treatment system inspection and maintenance shall be in accordance with the Operations and Maintenance (O&M) section of the Stormwater Pollution Prevention Plan (SWPPP) and the product manufacturer's published guidance.

E. Accessories:

1. Spacers can be used to obtain the required minimum spacing between chamber rows.

2. During construction inlet filters or pipe plugs on all inlet pipes to the stormwater chamber system shall be used to prevent construction sediment from entering

the Treatment Row system. Pipe plugs to be removed once construction of the system is complete and no further construction sediment loading is expected.

F. Imported Granular Backfill above Stormwater Retention Structures: Shall be as specified in Section 312201, 2.1, B.

2.07 PIPE SLEEVE AND WATERPROOF SEALS

A. Sleeves shall be constructed of steel with a water stop and anchor collar, 2" minimum. Sleeve length shall equal foundation wall thickness. Waterproof seals shall be rubber. Standard of quality: shall be the Link Seal Wall Sleeve and Link Seal Gasket as manufactured by the Thunderline Corporation or Architect approved equal.

PART 3 - EXECUTION

3.01 CONNECTIONS TO OTHER STORM SYSTEM

A. Connections at Building(s):

1. Locate accurately per site and plumbing drawings. Verify invert and sizes. Notify Architect of any discrepancies immediately, prior to installation.

2. Install pipe and jointing to within five (5') feet of each building exterior. Install temporary plugs, cap end, mark above grade, and protect. Coordinate with Plumbing Contractor. Connection will be made by Plumbing Contractor.

3. The Plumbing Contractor shall be responsible for connecting the building drains and leaders to the site storm system.

4. Make connections securely, watertight and as detailed. Provide all necessary couplers and fittings to make connections.

B. Connections to existing Storm Systems:

1. Coordinate with the Municipality and other agencies having jurisdiction. Notify governing agency in writing a minimum of two (2) weeks prior to anticipated date of connection so that field procedures and installation can be reviewed by a representative of the Municipality. Copy letter to Architect.

2. Locate accurately per drawings. Verify inverts and sizes. Notify Architect of any discrepancies immediately, prior to installation.

3. Make connections securely, watertight and as detailed. Provide all necessary couplers and fittings to make connections.

3.02 TRENCHING AND BACKFILL

A. Reference: Refer to Section 312201 for elaboration of shoring and bracing, supporting, rock, dewatering, and backfilling.

B. Trenching:

1. Remove material encountered to the depth shown on drawings and with a maximum width of fourteen (14") inches and a minimum of nine (9") inches each side of conduit springline as detailed. Provide safe shoring, sheeting, and

bracing. Remove before backfilling. Backfill excess or over excavation as described in Section 312201 to proper line and grade. Compact to 95% density.

2. When unsatisfactory soil materials are encountered at design elevations, immediately notify the Architect in writing via email. Continue as directed by the Architect. When conditions are not a result of Contractor's negligence, additional excavation may be directed by the Architect and paid for as a Change Order on a unit price basis in accordance with specification Section 312201.

C. Water: Remove from trenches; drain trenches and/or provide sump pits and pumping equipment as necessary to keep trenches stabile and dry at no additional cost to the Owner.

D. Soft Material in Trench Bottom: Dry out and stabilize or remove and replace with imported granular backfill material to achieve firm, stable foundation at no additional cost to the Owner.

E. Rock: Remove boulders and rock within one (1'-0") foot of pipe. Provide one (1'-0") foot of granular backfill between rock and conduits at no additional cost to the Owner.

F. Backfill: Conform to details on drawings and as specified. Compact backfill to a minimum 95% of optimum density.

3.03 STORM STRUCTURES INSTALLATION

A. Pre-Cast Structures:

1. Install with corresponding extended precast base section. Precast base units shall be modified in the factory to have the correct size openings for piping.

2. Provide drainage structures as detailed, built to finished grades given. Backfill with imported granular backfill material around drainage structure and compact to 95% density to avoid settlement.

3. Mortaring: Thoroughly wet concrete risers before laying. Mortar joints. Joints shall be completely full and struck flush.

4. Install any required steps in a continuous flight, avoiding any conflict with piping.

5. Construct channels in base of storm structures for positive flow from inlet to outlet piping where detailed.

6. Build completed structure to avoid any infiltration or exfiltration of water except at underdrains or storm water management trenches.

3.04 CASTINGS

A. Provide the type specified and shown on drawings. Build to the finish grade as shown on drawings.

B. Set castings firmly. Loose or rocking castings shall be rejected by the Architect.

C. Paint all installed castings (inside and outside) with two (2) coats of black rust inhibitive paint as directed by the Architect.

3.05 ADJUSTING EXISTING UTILITIES

Adjust existing utilities as necessary to maintain utility service and meet finished grade conditions. Existing utilities include but are not limited to; water valve boxes, gas valves boxes, electric pull boxes, storm drainage frames, cable and telephone markers, and cleanouts.

3.06 PIPE LAYING

A. Shall be in accordance with ASTM D2321 and pipe manufacturer requirements.

B. Bed pipe in granular backfill or concrete as shown on drawings, compact under springline of pipe to assure firm support. Align pipe to line and grade given in plan and profile. Set batter boards or set by laser level.

C. Pipe joints shall be made using the flexible gaskets specified. Clean bell end of any debris and lubricate. Remove protective wrap from gasket. Do not allow lubricated section to touch dirt or backfill. Foreign matter could adhere to surface and compromise joint integrity. Push together pipes so that the gasket is firmly seated in the socket. Always push spigot end into bell, not bell end into spigot.

D. Place backfill around pipes to equal depths on both sides as work progresses.

E. Attach flared end sections as detailed to pipe outlets, draw up bolts tight to provide firm anchorage.

F. "Lamp" pipes to check for misalignment and breakage after backfilling has been completed. Replace pipes deviating more than 1/2" from line or grade at no additional cost to the Owner.

3.07 STORM WATER MANAGEMENT TRENCH

A. Use only pipe which is undamaged and flexible (have not been exposed to direct sunlight for more than six (6) months causing brittleness, cracking or splitting prior to placement). Pipe shall be stored for at least twenty-four (24 hrs.) hours in an area having a minimum temperature of fifty (50) degrees F.

B. Trenching: Remove material encountered to the depth shown on the drawings. Provide shoring, sheeting, and bracing as necessary for safety; remove before backfilling.

C. Install continuous envelope of soil separation fabric around the backfill up to subgrade of finish material. Fill stone to proper elevation and wrap top. Overlap fabric minimum twenty-four (24") inches at top and joints. Secure fabric joints to prevent separation and infiltration of adjacent materials and separation of fabric.

D. Install pipe sloped as shown on drawings.

E. Compact backfill to maximum density of adjacent materials.

3.08 STORM WATER RETENTION STRUCTURES

A. Locate, stabilize and protect areas prior to bed excavation. Delineate perimeter of beds with silt fence to keep silt and heavy equipment out.

B. Chambers shall not be installed until the manufacturer's representative has completed a pre-construction meeting with installers.

C. Install as detailed and according to manufacturer's recommendations. Do not use crushed or recycled concrete in the installation or for backfill on the installation. Compact backfill to maximum density of adjacent materials.

D. Chambers are not to be backfilled with a dozer or an excavator situated over the chambers.
   1. Manufacturer recommends three backfill methods:
      a. Stoneshooter located off the chamber bed.
      b. Backfill as rows are built using an excavator on the foundation stone or subgrade.
      c. Backfill from outside the excavation using a long boom hoe or excavator.

E. The foundation stone shall be leveled and compacted prior to placing chambers.

F. Joints between chambers shall be properly seated prior to placing chambers.

G. Maintain minimum - nine (9") inches spacing between the chamber rows.

H. Inlet and outlet manifolds must be inserted a minimum of twelve (12") inches into chamber end caps.

I. Stone must be placed on the top center of the chamber to anchor the chambers in place and preserve row spacing.

J. Continue protecting beds during and after installation until final acceptance. Prevent heavy equipment and stockpiled materials from crushing or damaging the units and misaligning the pipes. Remove and replace damaged units, pipes and materials. Do not incorporate damaged materials into any installation.

3.09 PIPE SLEEVE AND WATERPROOF SEAL

A. Locate and install sleeves were indicated on the drawings. Maintain the same line and grade of the storm pipe. Coordinate the installation of the sleeve with the other contractors prior to installation.

B. Provide the waterproof seal between sleeve and storm pipe. Installation shall be approved by the Architect before backfilling is installed.

3.10 FIELD QUALITY CONTROL

A. Density Testing: Perform all density testing for piping trenches and structure backfill as indicated in Section 312201.

3.11 CLEAN UP

A. During the contract and at intervals as directed by the Architect and as storm drainage is completed, clear the site of pipe, trench and backfill material, stone, concrete and debris. Leave the site in a clean, safe, well draining, neat condition.

B. Clean drainage structures, storm water management trenches and pipes: Clean out sediment, rubbish, construction debris, and foreign objects thoroughly, immediately prior to final acceptance.

END OF SECTION 33 40 01

SECTION 41 22 00

HOISTS AND CRANES

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Cranes, Hoists and Lifts of the Following Types:
   1. Free standing work stations bridge crane in Welding Lab.
   2. Ceiling mounted steel monorail crane in HVAC Lab.

1.2 REFERENCES

A. American Institute of Steel Construction (AISC) - Manual of Steel Construction, Part 5, Specification for Structural Joints Using ASTM A325 or ASTM A490 Bolts.

B. American National Standards Institute (ANSI):ANSI B30.11 - Monorails and Underhung Cranes.

C. ASTM International (ASTM):
   1. ASTM A36 - Carbon Structural Steel.
   2. ASTM A325 - Structural Bolts, Steel, Heat Treated, 120/150 ksi Minimum Tensile Strength.
   3. ASTM A490 - Structural Bolts, Alloy Steel, Heat Treated, 150 ksi Minimum Tensile Strength.
   4. ASTM B221 - Aluminum-Alloy Extruded Bar, Rod, Wire, Shape, and Tube.

D. American Welding Society (AWS) D1.1 - Structural Welding Code.

E. Occupational Safety and Health Administration (OSHA) - Specification 1910.179 - Overhead and Gantry Cranes.

1.3 SUBMITTALS

A. Submit under provisions of Section 01 30 00 - Administrative Requirements.

B. Product Data: Manufacturer's data sheets on each product to be used, including:
   1. Describe capacities, performance, operation, and applied forces to foundation.
   2. Preparation instructions and recommendations.
   3. Storage and handling requirements and recommendations.
   4. Installation methods.

C. Shop Drawings: Shop drawings showing configuration, dimensions, service area, and construction and installation details stamped by New York State licensed structural engineer.

D. Design and Performance Data.

E. Manufacturer’s qualification statement.

F. Warranty Documentation.

1.4 ADMINISTRATIVE REQUIREMENTS

A. Preinstallation Meeting: Convene a preinstallation meeting one week before the start of this section; required attendance by owner, architect, construction manager, general contractor, electrical contractor.

1.5 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in designing and manufacturing cranes with 5 years successful experience.

B. Installer Qualifications: Company experienced in assembly and installation of cranes with 5 years successful experience and acceptable to crane manufacturer.
   1. Perform welding by certified operators in accordance with AWS D14.1.
   2. Bolted connections shall be in accordance with torque tightening procedures specified in AISC Manual, Part 5.
   3. Clearly label crane with rated load capacity. Place label at height and location easily read from floor level and loading position.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Store products in manufacturer's unopened packaging until ready for installation.

1.7 PROJECT CONDITIONS

A. Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's recommended limits.

1.8 WARRANTY

A. Manufacturer's Warranty: On manufacturer's standard form, in which manufacturer agrees to repair or replace assemblies and components that fail in materials and workmanship within warranty period from date of Substantial Completion.
   1. 5 years or 10,000 hours warranty for manual push-pull work station crane, jib crane, and gantry crane products to cover defects in materials and workmanship.
   2. 2 years or 4,000 hours warranty for motorized tractor products.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Gorbel Inc., located at: 600 Fishers Run; Fishers, NY 14453; Toll Free Tel: 800-821-0086; Tel: 585-924-6262; Fax: 800-828-1808; Email:request info (info@gorbel.com); Web:http://www.gorbel.com/Solutions/architectsandengineers.aspx

B. Approved Equivalent

C. Requests for substitutions will be considered in accordance with provisions of Section 01 60 00 - Product Requirements.

2.2 BRIDGE CRANES

A. Performance:
   1. Crane shall provide coverage of rectangular area of size indicated on Drawings and consist of:
      a. Support structure requiring only primary structural support without longitudinal or lateral bracing.
      b. Two rigid, parallel runways. Cranes with more than two runways or with articulating runways are not acceptable.
      c. Rigid, single girder bridge moving perpendicular to runways or monorail. Double girder bridges and ones with articulating or threaded connections are not acceptable.
   2. Modular, pre-engineered design: Crane system shall be capable of expansion,

disassembly, and relocation, and accepting additional or multiple mixed capacity bridges.
   a. Crane shall be designed, fabricated, and installed in accordance with ANSI B30.11, and OSHA 1910.179.
3. Productivity ratio: Crane shall be designed to manually move load with maximum force of 1/100 load weight.
4. Runway and bridge track: Enclosed type limiting dust and dirt collection on rolling surfaces with maximum deflection of 1/450 span based on capacity plus 15 percent for lifting device weight.
5. Crane operating temperature: 5 to 200 degrees F (-15 to 93 C).
6. Crane shall be designed to withstand:
   a. Structural design shall include full rated load capacity plus 15 percent for hoist and trolley weight and 25 percent impact factor for speed of lifting device and weight of tooling.
   b. Crane and hoist dead load.
   c. Live load capacity equal to net rated hook load: 4000 pounds (1816 kg).
   d. Inertia forces from crane and load movement.

B. Free Standing Bridge Crane: Work station, bridge crane with free standing support structure, two runways, bridge moving perpendicular to runways, and equipped with enclosed track, end trucks, hoist trolley, festooning system, bumpers, and other accessories.
1. Acceptable Manufacturer and Model:
   a. Model GLCSLX-FS: Cranes with trussed steel runways supported at 30 feet (9.1 m) maximum as manufactured by Gorbel Inc or approved equivalent.
   b. Electrically Operated.
2. Construction: Fabricate from ASTM A36 steel sections with finished ends and surfaces.
3. Support structure: Support crane runways with frames consisting of two columns and horizontal header.
   a. Columns: Square tubes with bottom base plate and top header plate.
   b. Header: Fabricated from two back-to-back channels spaced apart and joined with welded end plates. Provide clamp plates, threaded rods, lock washers, and hex nuts for attaching header to column.
   c. Hanger assemblies: Provide support frames with pairs of hanger assemblies that provide a rigid connection for suspending runways. Assembly to consist of clamp angle, clamp plates, threaded rods, lock washers, and hex nuts.
4. Runways: Vierendeel truss fabricated from square steel tubes and enclosed steel track.
   a. Track: Enclosed, cold formed, steel box track which serves as bottom cord of runway and permits end trucks and festoon carriers to ride on lower inside flanges. Fabricate lower running flanges with 2 degrees taper to center trolley within track. Flat, non-centering tracks are not acceptable.
   b. Splice joint: Provide truss splice plates, channel-shaped track splice joint, bolts, lock washers, and nuts for joining runway sections. Splice joints must be located within four feet of a support point.
   c. Runway Cantilevers: Up to 4 feet (1219 mm) of cantilever is allowed from a hanger location to the end of the runway.
   d. Festoon stack section: Provide enclosed track extension to provide for stacking festoon carriers at end of runway.
5. Bridge: Single girder, Vierendeel truss fabricated from rectangular steel tubes and enclosed steel box track; patented truss design for 4000 lb. capacities.
   a. Track serves as bottom cord of bridge and permits hoist trolley and festoon carriers to ride on lower inside flanges.
   b. Fabricate lower running flanges with 2 degrees taper to center trolley within track. Flat, non-centering tracks are not acceptable.
6. Bridge: Enclosed, cold formed steel box track which permits hoist trolleys and festoon

carriers to ride along track lower inside flanges. Fabricate lower running flanges with 2 degrees taper to center trolley within track. Flat, non-centering tracks are not acceptable.

7. Bridge: Patented extruded aluminum enclosed track reinforced with extruded aluminum T-beam.
   a. Provide as either one piece extrusion or with separate T-beam bolted to track.
   b. Track: Enclosed, box track designed for trolleys and festoon carriers to ride on lower inside flanges. Fabricate lower running flanges with 2 degrees taper to center trolley within track. Flat, non-centering tracks are not acceptable.
8. End trucks: Rigid frame end truck designed to ride inside enclosed runway track and connect to and suspend bridge.
   a. Construction: Stamped steel fabrication with both vertical and horizontal wheels to prevent binding in runway. Designs with welds in tension are not acceptable.
   b. Wheels: Removable, self-centering wheels with sealed lifetime lubricated bearings. Vertical wheels shall be tapered 2 degrees to match track profile. Non-removable or non-tapered wheels are not acceptable. Duracomp 4 wheel material as provided by Gorbel Inc. or approved equivalent. Steel wheels are not acceptable.
   c. Drop lugs: Provide on both sides of truck to limit truck drop in the event of wheel, axle, or load bar failure.
   d. Connection to the bridge: Provide a rigid connection between bridge and end truck. Articulating connections with threaded hardware are not acceptable.
   e. Designed for easy attachment of peripherals.
9. Hoist trolley: Rigid-body trolley designed to ride inside enclosed track of bridge and to carry hoist and load. Articulating trolleys are not acceptable.
   a. Construction: Two-piece stamped steel body with two wheels each side and tapered clevis positioning hoist hook at center of trolley so load weight is evenly distributed to all four trolley wheels. Provide removable clevis pin of type and size determined by manufacturer for specified capacity. Trolleys with non-removable clevis pins are not acceptable. Holes provided in body for mechanical connections.
   b. Wheels: Removable, self-centering wheels with sealed lifetime lubricated bearings. Vertical wheels shall be tapered 2 degrees to match track profile. Non-removable or non-tapered wheels are not acceptable. Duracomp 4 wheel material as provided by Gorbel Inc. or approved equivalent. Steel wheels are not acceptable.
   c. Drop lugs: Provide on both sides of trolley to limit trolley drop in the event of wheel, axle, or load bar failure.
   d. Designed for easy attachment of peripherals.
10. End stops: Molded composite, resilient bumper installed in runway and bridge tracks to prevent end trucks, hoist trolley, and festoon carriers from rolling out of track. Bolt stops without energy absorbing bumper are not acceptable.

C. Ceiling Mounted Monorail Crane: Ceiling mounted, work station, all-steel construction, monorail crane with overhead hanger assemblies, enclosed track, hoist trolley, festooning system, bumpers, and other accessories.
   1. Acceptable Manufacturer and Model:
      a. Model No. GLMS: Cranes with trussed steel monorail supported at 20 feet (6.1 m) maximum as manufactured by Gorbel, Inc. or approved equivalent.
      b. Manually Operated.
   2. Construction: Fabricate from ASTM A36 steel sections with finished ends and surfaces.
   3. Hanger assemblies: Provide number and type of hanger assemblies required for suspending monorail from overhead steel beam support structure.
      a. Equip assemblies with upper hanger bracket adjustable for mounting from 1 to 10 inches (25 mm to 254 mm) flanges and two beam clips.

b. Two-piece hangers suspending monorail below support beams shall consist of upper hanger bracket (fits flanges from 1 inches to 10 inches (25 mm to 254 mm)) with beam clips and lower monorail bracket connected with threaded B7 alloy steel rod. Provide rods in 20 and 72 inches (508 mm and 1829 mm) lengths for field cutting. Assemblies shall be designed for supporting either plain enclosed steel track monorails or trussed steel monorails.
c. Hangers for flush mounting plain enclosed steel track monorail shall be one-piece assembly designed for monorail either parallel or perpendicular to support beams.

4. Sway bracing: Brace monorail as required per manufacturer's requirements. Provide monorail with sway brace fittings for attachment of diagonal pipe bracing to top chord of trussed monorail.
5. Monorail: Vierendeel truss fabricated from square steel tubes and enclosed steel track.
   a. Track: Enclosed, cold formed, steel box track which serves as bottom cord of monorail and permits hoist trolley and festoon carriers to ride on lower inside flanges. Fabricate lower running flanges with 2 degrees taper to center trolley within track. Flat, non-centering tracks are not acceptable.
   b. Splice joint: Provide truss splice plates, channel-shaped track splice joint, bolts, lock washers, and nuts for joining monorail sections.
6. Monorail: Enclosed, cold formed, steel box track which permits hoist trolley and festoon carriers to ride along monorail.
   a. Fabricate lower running flanges with 2 degrees taper to center trolley within track. Flat, non-centering tracks are not acceptable.
   b. Splice joint: Provide channel-shaped track splice joint with bolts, lock washers, and nuts for joining monorail sections.
7. Festoon stack section: Provide enclosed track extension to provide for stacking festoon carriers at end of monorail.
8. Hoist trolley: Rigid-body trolley designed to ride inside enclosed track of bridge and carry hoist and load. Articulating trolleys are not acceptable.
   a. Construction: Two-piece stamped steel body with two wheels each side and tapered clevis positioning hoist hook at center of trolley so load weight is evenly distributed to all four trolley wheels. Provide removable clevis pin of type and size determined by manufacturer for specified capacity. Trolleys with non-removable clevis pins are not acceptable. Holes provided in body for mechanical connections.
   b. Wheels: Removable, self-centering wheels with sealed lifetime lubricated bearings. Vertical wheels shall be tapered 2 degrees to match track profile. Non-removable or non-tapered wheels are not acceptable. Duracomp 4 wheel material as provided by Gorbel Inc. or approved equivalent. Steel wheels are not acceptable.
   c. Drop lugs: Provide on both sides of trolley to limit trolley drop in the event of wheel, axle, or load bar failure.
   d. Designed for easy attachment of peripherals.
9. End stops: Molded composite, resilient bumper installed in monorail track to prevent hoist trolley and festoon carriers from rolling out of track. Bolt stops without energy absorbing bumper are not acceptable.
10. Radius: 4'-0".
11. Capacity: 1,000 lbs.

D. Tractor Drive:
1. Provide electric tractor drive for motorized operation of hoist trolley and end truck as indicated or scheduled; Tractor Drive as manufactured by Gorbel, Inc or approved equivalent.
   a. Type: Variable frequency drive assembly with worm gear reducer, molded polyurethane tread, and adjustable counterbalance to ensure proper drive

wheel alignment.
b. Speed: 70 feet per minute (21.3 m per minute).
c. Motor: 1/3 HP, 1800 RPM, 3 phase, 208-460 volt, with thermal overload protection.
d. Controls: 120 volt control package with transformer, terminal strips, fusing, enclosure, and mounting brackets.

E. Festoon Assemblies:
1. Provide length of cable and/or air hose to supply lifting device. Supply shall be festooned along bridge and runway. Refer to drawings for type and size.
2. Festoon trolleys: Four-wheeled trolleys with pivoting saddle and applicable attachment to support service run on runway or bridge and allowing festooning as end truck or hoist trolley travels.
3. Festoon gliders: T-shaped gliders with adjustable applicable attachment to support service runs on runway or bridge and allowing festooning as end truck or hoist trolley travels.
4. Festoon clamp: Steel clamp assembly attached to track to prevent festoon trolleys and gliders from exiting track.
5. Festoon tow clamp: Steel clamp assembly attached to track to prevent festoon from binding under with end truck or trolley.

2.3 ELECTRIC CHAIN HOISTS

A. Performance Requirements: Electric chain hoists.
1. Designed, fabricated, and installed to comply with applicable requirements of ASME, FEM/ISO, NFPA 70 and OSHA.
2. Lift and lower loads in response to operator's use of pendant controller.
3. Capacity Overload: Hoist must not lift load that exceeds rated capacity.
4. Hoists are shipped with the clutch set for 10 percent higher than the rated capacity.
5. Power Loss Protection: Braking system to lock hoist in place in event of power loss.

B. Electrically powered, pendant operated chain hoist to be attached to trolleys on cranes and other material handling equipment to lift and move loads;
1. Model: GEHC Series Hoist as manufactured by Gorbel, Inc. or approved equivalent
a. Speed: Single.

C. Operational Functions:
1. Design and fabricate chain hoist to lift specified load and perform functions described in the "Performance Requirements" Paragraph.
a. Lifing Capacity Options: 1/8, 1/4, 1/2, , 1-1/2, 2 tons.
2. Lifting Capacity: 2 tons.
3. Electrical requirements as indicated on drawings.

D. Construction: Chain hoist is housed in an aluminum, compact housing and include these features:
1. Low voltage, 24 VAC control circuit for operator protection.
2. Modular DC brake and clutch is easily accessible for routine inspection and/or service.
3. Totally enclosed, fan cooled motor.
4. Case hardened gears and other components.
5. Mainline contactor controlled by Emergency-Stop on the pendant control handle.

E. Hoist Control: Pendant type control device to functionally operate chain hoist as indicated on reviewed shop drawings.
1. Type: Pendant type control handle equipped with:
a. UP, DOWN switch and Emergency Stop to operate hoist.
b. Pendant cable with wire rope strain relief.
2. Limit Switches: Equip chain hoist system with modular upper and lower limit switches.

F. Accessories:
   1. Chain Container: Manufacturer's standard canvas bag type.
   2. Chain Container: Manufacturer's standard plastic bucket type.

G. Suspension: Single hole suspension plate offering lower headroom loss for applications using a clevis pin or bolt connection, such as Workstation Cranes.

H. Suspension: Double hole suspension plate for use with GSH trolleys on structural beam (jib cranes) or Patented Track cranes.

I. Suspension: Rigid hook for the more common "universal" means of connection. Useful for moving hoists among various locations or suspending from lifting eyes or closed rings.

2.4 TROLLEYS

A. Trolley Type: Motor-Driven Single Speed for Bridge Crane in Welding Lab

B. Trolley Type: Manual, Push (Up to 1 tons) for Monorail in HVAC Lab

2.5 SHOP FINISHING

A. Steel: Steam wash steel crane components with iron phosphate solution and apply blue or yellow baked enamel finish.

B. Aluminum: Mill finish.

C. Provide spray can of matching color, air-drying paint for field touch-up.

PART 3 EXECUTION

3.1 EXAMINATION

A. Do not begin installation until support structures have been properly prepared.

B. Design and construction of reinforced concrete footings and slabs as detailed on Drawings and specified in other sections. Verify that accurate crane applied forces and anchor bolt patterns are provided for foundation design.

3.2 INSTALLATION

A. Install units and accessories in accordance with manufacturer's instructions and approved shop drawings. Do not modify crane components in any manner without advance written approval by crane manufacturer.

B. Clearances for Moving Crane Components:
   1. 3 inches (76 mm) minimum vertical clearance from any overhead obstruction.
   2. 2 inches (51 mm) minimum horizontal clearance from any lateral obstruction.
   3. Prior to applying proper torque to the bolts, ensure runways are:
      a. Level to within plus or minus 1/8 inch in 20 feet (3 mm in 6.1 m).
      b. Parallel with opposite runway to within plus or minus (3 mm in 6.1 m).

3.3 FIELD QUALITY CONTROL

A. Perform field quality control testing as recommended by manufacturer. Move bridge and hoist trolley through entire travel to ensure crane is clear of obstructions and moves freely and smoothly. Inspect installed crane. Verify all bolts are tight and lock washers fully compressed.

B. Field test crane and accessories for operating functions. Ensure crane movement is smooth and proper. Adjust as required and correct deficiencies.

C. Clean surfaces. If necessary, touch-up paint damage, scratches, and blemishes with manufacturer provided matching paint. Protect crane from other construction operations.

3.4 DEMONSTRATING AND TRAINING

A. Provide demonstration and training session for Owner's representative covering operation and maintenance.

3.5 PROTECTION

A. Protect installed products until completion of project.

B. Touch-up, repair or replace damaged products before Substantial Completion.

END OF SECTION