PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The general conditions, Division 26, and Basic Electrical Materials and Methods (Section 260500) are part of this section and the contract for this work and apply to this section as fully as if repeated herein.

B. Reference to other sections: The applicable requirements from other Division 26 sections required for a complete and operational system shall form a part of the electrical work and each section shall be thoroughly reviewed by the Contractor for application to all other sections.

1.2 SCOPE

A. Provide labor, materials, tools, and equipment necessary for and incidental to performing all operations in connection with furnishing, delivery and installation of the equipment of this section, as shown on the drawings and specified herein.

B. Furnish and install complete lighting systems, wired, assembled and operable, except where specifically noted otherwise, which includes but not limited to the following:
1. Luminaires
2. Lamps and ballasts
3. Mounting hardware
4. Accessories as noted

C. The materials and equipment herein specified shall be of new and furnished in accordance with the applicable standards.

D. Specifications and drawings are intended to convey the general features, function and character of the fixtures only, and do not illustrate or set forth every item or detail necessary of the work.

1.3 SUMMARY

A. Section Includes:
1. Interior fluorescent luminaires, lamps, and ballasts.
2. Interior solid-state luminaires that use LED technology.
3. Luminaire supports.

B. Related Requirements:
1. Section 260923 "Lighting Control Devices" for automatic control of lighting, including time switches, photoelectric relays, occupancy sensors, and multipole lighting relays and contactors.
2. Section 260936.19 "Standalone Multipreset Modular Dimming Controls" for architectural dimming systems and for fluorescent dimming controls with dimming.
3. Section 260943.23 "Relay-Based Lighting Controls" for manual or programmable control systems with low-voltage control wiring or data communication circuits.

1.4 DEFINITIONS

A. CCT: Correlated color temperature.

B. CRI: Color Rendering Index.

C. Fixture: See "Luminaire."

D. LED: Light-emitting diode.

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

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

1.5 SUBMITTALS

A. Shop drawings for all fixtures shall be submitted and reviewed prior to fabrication. Any material produced prior to the review of shop drawings or samples, and not in conformance with the Contract Documents, shall be rejected with the Contractor bearing full responsibility and cost. Submit shop drawings per Section 260500 for review, include the following:
   1. Luminaires
   2. Lamps
   3. Ballasts
   4. Photometric reports
   5. Point-by-point calculations specific to the project.
   6. Accessories

B. Submit shop drawings indexed, and in accordance with luminaire identification per drawings. Each item shall be tabbed, clearly identifying the catalog ordering numbers including all optional equipment specified.

C. Luminaire shop drawings shall include the following:
   1. Manufacturer's product information sheets. Photocopy of partial data sheet or drawings is not acceptable. Product information shall include the following:
      a. Ballast type, manufacturer and performance characteristics
      b. Lamp type, manufacturer and performance characteristics
      c. Finish, frame, trim and housing type
      d. Reflector system and characteristics
      e. Diffuser type and characteristics
      f. Weight and dimensions
      g. Standard manufacturer options
      h. Luminaire series and model number
      i. Luminaire efficiency
      j. Coefficient of utilization
      k. Candlepower data table
      l. Zonal lumens table
      m. IES luminaire classification
      n. Maintenance and operating instructions including tools required, types of cleaners to be used and suggested replacement parts list.
      o. Average foot candle table.
   2. Photometric data assembled in a standard IES photometric test report.

3. LEED Submittals: Product Data for Credit IEQ 4.2: For paints and coatings, documentation including printed statement of VOC content.

D. Lamp shop drawings shall include type, dimensions, manufacturer and operating characteristics, including but not limited to:
1. Operating voltage range
2. Color Rendering Index (CRI) value per IES standards
3. Color temperature (in Kelvin)
4. Mounting position
5. Starting temperature, indoor and outdoor
6. Starting/restrike time
7. Lamp life
8. Lamp efficiency
9. Warranty
10. Lamp base
11. Lumen rating

E. Ballast shop drawings shall include type, dimensions, manufacturer and operating characteristic including but not limited to:
1. Ballast operating temperature and voltage
2. Total harmonic distortion
3. Ballast starting/restrike time
4. Ballast efficiency factor (BEF)
5. Ballast transformation type (ie: autotransformer, preheat, instant-start, rapid start, constant wattage, reactor, trigger-start)
6. UL classification (ie: Class "P")
7. Power factor
8. Sound rating (fluorescent only)
9. NEMA rating

F. If requested by the Engineer, samples shall be submitted for final selection. Samples shall comply with the following:
1. Paint chips:
   a. Samples shall be provided and approved prior to any release to manufacture.
   b. Samples shall be minimum of 3"x3" and be of exact finishes.
   c. Samples shall be exact representatives of the luminaires:
      1) Priming process
      2) Painting process
      3) Baking process
      4) Finish process
      5) Luminaire material (i.e. sheet metal, aluminum, wood, etc)
   d. Samples shall be labeled with manufacturers color call-out, as well as the paint manufacturer's call-out.
2. Fixtures:
   a. Submit for approval samples called for to the Engineer when and where directed, the components marked with the name of the project, and fixture type, and part number. Fixture shall be provided with a 6' cord and plug, and specified lamp. Allow two weeks from the date of receipt for thorough examination and review by the Engineer.

b. Fixtures under the contract shall be identical with the approved sample fixture. No fixture used as a sample shall be allowed to be installed on the project.
c. In the event the submissions are disapproved, the fixtures shall be returned to the contractor to immediately make a new submission of fixture or fixtures meeting the contract requirements.
d. All charges for these shipments are to be prepaid by the Contractor.
e. Samples shall be provided and approved prior to any release to manufacture.

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

H. Operation and Maintenance Data: For luminaires and lighting systems to include in maintenance manuals.
1. Provide a list of all lamp types used on Project; use ANSI and manufacturers' codes.

I. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
1. Lamps: Ten for every 100 of each type and rating installed. Furnish at least one of each type.
2. Diffusers and Lenses: One for every 100 of each type and rating installed. Furnish at least one of each type.
3. Globes and Guards: One for every 20 of each type and rating installed. Furnish at least one of each type.

1.6 FACTORY TESTING

A. Luminaire testing shall be conducted by an approved independent testing laboratory.

B. Luminaire tests shall be reported in accordance with Illuminating Engineering Society (IES) Standard Photometric Test Report.

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

1.7 QUALITY ASSURANCE

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

B. Mockups: For interior luminaires in room or module mockups, complete with power and control connections.
1. Obtain Architect's approval of luminaires in mockups before starting installations.

2. Maintain mockups during construction in an undisturbed condition as a standard for judging the completed Work.
3. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
4. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.8 WARRANTY

A. Contractor shall warranty equipment and installation free from defects in material and workmanship for a period of no less than (1) year from the date of project acceptance. This includes the fixture, its finishes and components (see ballasts below).

B. Fluorescent ballasts shall be warrantied against defects in material and workmanship for a period of no less than (5) years for electronic ballasts, from the date of project acceptance regardless of the date of manufacture.

C. Provide manufacturer's warranty covering 5 years on drivers from date of purchase.
1. LED dimming driver.
2. 3-Wire (Line Voltage Controlled) Dimming Drivers
3. Digital (Low Voltage Controlled) Dimming Drivers
4. Forward Phase Control (neutral wire required) (Line Voltage Controlled) Dimming Drivers

1.9 DELIVERY, STORAGE, AND HANDLING

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

PART 2 - PRODUCTS

2.1 GENERAL

A. Luminaries shall bear the appropriate UL label for location, mounting position and operating conditions in which it is installed.

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

C. Seismic Performance: Luminaires shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.
1. The term "withstand" means "the luminaire will remain in place without separation of any parts when subjected to the seismic forces specified."

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

E. NRTL Compliance: Luminaires for hazardous locations shall be listed and labeled for indicated class and division of hazard by an NRTL.

F. Lamp base complying with ANSI C81.61.

G. Bulb shape complying with ANSI C79.1.

H. Recessed Luminaires: Comply with NEMA LE 4.

I. EMI Filters: Factory installed to suppress conducted EMI according to MIL-STD-461E. Fabricate luminaires with one filter on each ballast indicated to require a filter.

J. Luminaries, ballasts and lamps shall each be of the same manufacturer and of identical finish, appearance, and performance. Luminaries which are pre-lamped before shipment shall have identical lamp manufacturer. Mix and match of different lamp manufacturer shall not be acceptable.

K. Recessed ceiling mounted luminaires shall be provided with appropriate frame and trim type compatible with ceiling construction. Reference architectural plans for ceiling construction type and specifications.

L. Luminaires and devices shall be free of burrs, scratches, marks, and dents which may occur during transportation, storage or installation. Construction shall be finished to eliminate sharp edges exposed to installer and end-user.

M. Sheet metal construction of luminaires shall be of sufficient rigidity to prevent deformation during installation and typical use.

N. Cast parts and sections of a luminaire shall be smooth, free of blemishes, rust and scale and be irradiated, sandblasted and anodized.

O. All burned out lamps and ballasts shall be replaced by the end of contract prior to Architect, Owner Representative and Engineer final punchlist.

P. Trim color for indoor luminaire installation shall be as indicated on plans.

Q. Enamel paint shall be baked on at a minimum 300 degrees F and have 86% reflectivity for a surface, which is to be reflective.

R. Fluorescent lamps
1. Unless specified on plans or in Lighting Fixture Schedule, the lamp color temperature shall be 4100 Kelvin (K).
2. Unless otherwise noted, lamps shall have a CRI (color rendering index) of 82 or greater.

S. Compact Fluorescent
1. Unless specified on plans or in Lighting Fixture Schedule, the lamp color temperature shall be 4100 Kelvin (K).
2. Unless otherwise noted, lamps shall have a CRI (color rendering index) of 82 or greater.
3. Lamp base and fixture socket shall match pin configuration.

T. LED – Light Emitting Diode
1. LED diodes shall be of the type with lifetime color stability within +/- 200K.
2. Diodes, modules, boards, etc. shall conform to IESNA LM70 and LM80 testing and binning standards.

3. LED lifespan, per IESNA LM80, shall be a minimum of 50,000 hours.
4. Unless specified on plans or in lighting fixture schedule, the LED color temperature shall be 4100 kelvin
5. Unless otherwise noted, lamps shall have a CRI (color rendering index) of 82 or greater.
6. Diodes, modules, and boards shall be replaceable in the field without replacement of housing or fixture.
7. Fixtures utilizing LED sources shall be UL listed and tested for proper heat dissipation.
8. Maximum inrush current of 2 amperes for 120V and 277V LED drivers.
9. Constant current drivers must provide models to:
   a. Support from 200mA to 2.1Amps (in 10mA steps) to ensure a compatible driver exists.
   b. Support LED arrays up to 40W or 50W (710mA to 1.05A in 10mA steps)
10. Constant voltage drivers must provide models to:
    a. Support from 10V to 40V (in 0.5V steps) to ensure a compatible driver exists.
    b. Support LED arrays up to 40W
11. LED drivers shall be integral to fixture.
12. LED drivers shall be dimmable from 100 percent to 0 percent of maximum light output.

U. Acceptable manufacturers
1. Fluorescent Lamps: Osram/Sylvania, 800 XP series
2. LED drivers: Philips

V. All lamps shall be burned once installed in the fixtures for 100 hours, prior to switching or dimming.

2.2 BALLASTS

A. General
1. Ballasts shall be UL listed when installed in luminaire.
2. Ballasts shall be grounded appropriately as governed by CEC Article 410.36(V).
3. Ballasts shall be located within the luminaire for which it is operating unless specifically indicated on plans as remote ballast type.
4. Ballasts shall contain no PCB's in any indoor or outdoor installation unless otherwise noted.
5. Ballasts shall be rated weatherproof type where there is moisture present.
6. A permanent waterproof seal shall be factory provided where the wiring enters the ballast compartment of an outdoor luminaire installation.

B. Fluorescent ballasts
1. Solid State Ballasts (Electronic)
   a. Electronic ballasts shall meet or exceed ANSI, IEEE, and FCC standards for lamp starting and operation, electromagnetic interference, radio frequency interference suppression and line transient protection.
   b. Electronic ballasts shall not interfere with other electrical equipment normal operation.

c. Electronic ballasts shall operate at a frequency of 20 to 35 kHz with no detectable flicker and be high power factor (97% or higher).
d. Electronic ballasts that operate more than one lamp shall be able to maintain full output of the companion lamp(s) after failure of any combination of lamp(s).
e. Electronic ballasts shall not be affected by lamp failure nor hinder the normal life of operating lamp.
f. Electronic ballast normal case operating temperature shall not exceed 70 degrees C.
g. Rapid-start electronic ballasts shall provide soft/stable start of rapid-start lamps and maintain full cathode heat during operation.
h. Electronic ballasts shall be marked with manufacturer's name, part number, supply voltage, power factor, open circuit voltage, current draw for each lamp type and bear all applicable UL listings on housing.
i. Electronic ballasts shall be universal voltage (120V – 277V).
j. Instant start ballasts are not acceptable.
k. Dimming ballasts shall be flicker-free and compatible with the lamp and dimming controller.
l. Exterior ballast shall be rated for cold weather conditions.
m. Designed for type and quantity of lamps served.
n. Ballasts shall be designed for full light output unless another BF, dimmer, or bi-level control is indicated.
o. Sound Rating: Class A.
p. THD Rating: Less than 10 percent.
q. Transient Voltage Protection: IEEE C62.41.1 and IEEE C62.41.2, Category A or better.
r. Lamp Current Crest Factor: 1.7 or less.
s. BF: 0.88 or higher.
t. Power Factor: 0.95 or higher.
u. Luminaires controlled by occupancy sensors shall have programmed-start ballasts.
v. Electronic Programmed-Start Ballasts for T8, T5, and T5HO Lamps: Comply with ANSI C82.11 and the following:
   1) Lamp end-of-life detection and shutdown circuit for T5 diameter lamps.
   2) Automatic lamp starting after lamp replacement.
w. Ballasts for Low-EMI Environments: Comply with 47 CFR 18, Ch. 1, Subpart C, for limitations on EMI and RFI for consumer equipment.
x. Ballasts for Dimmer-Controlled Luminaires: Electronic type.
   1) Dimming Range: 100 to 5 percent of rated lamp lumens.
   2) Ballast Input Watts: Can be reduced to 20 percent of normal.
   3) Compatibility: Certified by manufacturer for use with specific dimming control system and lamp type indicated.
   4) Control: Coordinate wiring from ballast to control device to ensure that ballast, controller, and connecting wiring are compatible.

C. Acceptable Manufacturers
   1. Solid state ballasts (electronic): Osram Sylvania or, Quicktronic, or approved equal.

2.3 LUMINAIRES

A. General

1. Escutcheon plates, coverplates, and finish trim hardware shall meet flush with ceiling, floor, wall or other surfaces to which they may be mounted.
2. Luminaire construction shall allow initial installation of recessed luminaires without the presence of finish trim, diffusers or lens.
3. Lamp sockets and reflector assemblies shall be securely fastened to luminaire housing to prevent rotation, adjustment or rocking of hardware during lamping or future relamping.
4. Luminaire lenses shall be securely retained in a fashion so that relamping or accessing to luminaire will not dislodge lens.
5. Luminaire lenses and diffusers shall be free from chromatic or spherical imperfections and have thermal characteristics capable of withstanding installed lamp temperatures.
6. Pendant type luminaries shall be mounted to provide balanced construction with the use of swivel hanger. Swivel hanger shall be provided standard or ordered as accessory unless specified otherwise.
7. Bracket type luminaires shall be specifically designed for type installation which is indicated.
8. Luminaries shall be factory tested, prewired and preassembled unless otherwise specified or intended.
9. Luminaires located in direct exposure to the weather to include rain, sleet and snow shall be marked "Suitable for Wet Locations" with UL label. Luminaires located outdoors but not in direct exposure to rain shall be marked "Suitable for Damp Locations" minimum rated.
10. Where ceiling space is not accessible, luminaire housing shall provide access to luminaire junction box to comply with CEC section 370-29.
11. Luminaires shall contain an integral ballast disconnect compliant with CEC section 410.73.

B. Fluorescent Luminaires

1. Recessed fluorescent luminaires shall be constructed to limit ballast housing surface temperature in luminaire to 90°C with the following factors:
   a. Voltage: 277V +5%, unless noted otherwise
   b. Room Ambient Temp: 25 degrees C + 5%
   c. Plenum Ambient Temp: 55 degrees C +5%
   d. Ceiling Material R Factor: 20
2. Medium BiPin type lamp socket shall be fastened securely to housing via brackets or straps to eliminate excessive flexing or pressure during normal lamp installation. Socket should be replaceable without removing entire housing.
3. Medium BiPin type lamp sockets without a housing shall be secured with (2) appropriate screws or bolts to prevent misalignment.
4. Fluorescent pin type sockets shall utilize corrosion-resistant "edge-wipe" type contacts.
5. Steel metal fluorescent luminaire housing shall be constructed of die formed, heavy duty, cold rolled steel. Housing shall be welded using lab seam construction and corners mitered and free of burrs, cracks, gouges, scratches.
6. Aluminum fluorescent luminaire housing shall be extruded or die formed in sections, which will positively interconnect to provide a rigid unit when assembled.

7. Steel metal construction of fluorescent luminaires housing shall be ribbed, section or paneled to provide internal structure.
8. Parabolic baffle optic control for fluorescent luminaires shall be semi-specular anodized, of low iridescent and constructed of sheet aluminum. Baffle shall be constructed to ensure rigidity and parabolic contours through interlocking cell assembly.
9. Prismatic lenses shall be of virgin acrylic plastic pattern 12 (0.125 inches thick pre-stressed to span 48-inches) unless specified otherwise on plans.
10. Compact fluorescent luminaire shall incorporate an End of Life (EOL) protection device.

C. Acceptable manufacturers shall be as specified on plans per Lighting Fixtures Schedule unless otherwise specified herein or on plans.

2.4 LUMINAIRE SUPPORT COMPONENTS

A. Comply with requirements in Section 260529 "Hangers and Supports for Electrical Systems" for channel and angle iron supports and nonmetallic channel and angle supports.

B. Single-Stem Hangers: 1/2-inch steel tubing with swivel ball fittings and ceiling canopy. Finish shall match luminaire.

C. Wires: ASTM A 641/A 641M, Class 3, soft temper, zinc-coated steel, 10 gauge.

D. Rod Hangers: 3/16-inch minimum diameter, cadmium-plated, threaded steel rod.

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

PART 3 - EXECUTION

3.1 FIELD QUALITY CONTROL

A. Any discrepancies with specified luminaire and its proposed use or environment shall be brought to the Engineer's attention as soon as possible.

3.2 EXAMINATION

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

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

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

3.3 TEMPORARY LIGHTING

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

3.4 INSTALLATION

A. Luminaires shall be installed complete with all accessories, glassware, canopies, sockets, reflectors, optics, wiring devices and supplied with new lamps of the type and wattage indicated on plans or in this specification unless specifically noted otherwise.

B. Comply with NECA 1.

C. All luminaires shall be supported in accordance with ASTM E-580 recommended guidelines for seismic restraint, as well as the latest version of the International Building Code related to lateral and vertical bracing, including but not limited to:
   1. Recessed luminaires shall have a minimum of four (4) #10 gauge wires attached to structure above; (1) wire at each corner of the luminaire. The wires shall be independent of ceiling support system.
   2. All lighting fixtures shall be positively attached to the suspended ceiling system. The attachment device shall have a capacity of 100 percent of the lighting fixture weight acting in any direction.
   3. Pendant-hung lighting fixtures shall be supported directly from the structure above with #9 gauge wire or approved alternate support without using the ceiling suspension system for direct support.

D. Mount luminaries in mechanical yards, areas and rooms to clear any mechanical equipment, conduit and clearances. Coordinate mounting with mechanical plans.

E. Junction box and ballast compartment shall be accessible from below when housing is installed in final position. Wiring shall be secured from damage when accessed for relamping.

F. Fire rated gypsum board enclosures shall be constructed around all recessed luminaires that penetrate fire rated areas.

G. All surface mounted luminaires installed on a suspended ceiling grid shall have four (4) supporting clips positively attaching corners of housing to the ceiling. Installation shall include 1/8" spacers between the housing and ceiling tile where applicable.

H. Actual locations of luminaires and dimensions shall be referenced to architectural drawings. Electrical plans shall not be used to scale for construction purposes. Any discrepancies shall be brought to the engineer's attention prior to installation.

I. Utilize modular wiring systems in the installation of luminaires where accessible and applicable. The system shall be complete with all required fittings, plugs, and cord drops for a complete operating system per specifications.

J. Provide additional junction boxes as required where conductor exceeds factory provided junction box limitations.

K. Installation shall be appropriately coordinated with all disciplines to insure proper ventilation and heat dissipation as required per manufacturer.

L. Where luminaires are served from two sources, a barrier shall be provided to separate emergency source from normal source with notation indicating separate sources.

M. Luminaires not utilizing modular wiring systems, shall be connected with maximum six (6) foot length of flexible metal conduit from a structurally mounted junction box.

N. Wall mounted luminaries and junction boxes shall be rigidly supported to structure to provide adequate support during normal operation.

O. Pendant luminaries shall be mounted in a uniform mounting height and in straight, parallel, continuous rows. Final coordination with the architectural reflected ceiling plan, mechanical equipment and plumbing fixtures shall be made in the field to ensure consistent spacing and locations.

P. All wall mounted fixtures shall be mounted to a supporting wall bracing material in addition to the junction box. The bracing material is secured to structural elements in the wall. The bracing shall be capable of supporting the weight of the fixture and comply with the manufacturer's requirements and recommendations.

Q. Remote Mounting of Ballasts: Distance between the ballast and luminaire shall not exceed that recommended by ballast manufacturer. Verify, with ballast manufacturers, maximum distance between ballast and luminaire.

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

S. Install lamps in each luminaire.

T. Coordinate layout and installation of luminaires and suspension system with other construction that penetrates ceilings or is supported by them.

U. Comply with requirements in Section 260519 "Low-Voltage Electrical Power Conductors and Cables" and Section 260533 "Raceways and Boxes for Electrical Systems" for wiring connections and wiring methods.

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

3.5 LABORATORY INSTALLATION

A. Luminaires mounted in a controlled environment such as a clean room shall be gasketed and sealed where the housing meets the ceiling with a continuous silicone-based resilient sealant bead.

B. Luminaires installed in a wet environment such as a wipe-down or hose-down laboratory shall bear the "Wet Location" UL listing and sealed waterproof with appropriate silicone based resilient sealant.

C. Ceiling openings installed in a sealed environment to insure accessibility to outlet boxes shall be gasketed to prevent any flow of air. The cover shall be constructed to ensure structural integrity for continuous removal from ceiling and be mounted with large head screws as required.

3.6 FIELD TESTING

A. Upon completion of installation, an operation test shall be conducted to show that all equipment operates in accordance with the requirement of this specification.

B. Upon completion of the installation, a field lighting survey shall be performed to verify that the designed illumination levels are satisfied. All large classrooms, laboratories, conference rooms, etc. shall be surveyed with a calibrated light meter.

C. All applicable tests shall be conducted in the presence of an Owner Representative and copies of any reports shall be provided.

D. Reports shall indicate when and where the test was conducted and who was present.

E. Upon completion of installations, luminaires requiring positioning shall be adjusted and aimed at final position.

3.7 CLEANING AND REPAIR

A. After complete lighting installation and before project completion, all damaged or faulty lenses or louvers in luminaires shall be replaced by the Electrical Contractor, at no additional cost to the Owner.

B. All anodized or highly visual or optically sensitive reflectors shall be cleaned of all fingerprints and smudges for a clean installation per manufacturer's recommendations.

C. All luminaries with paint scratches, dents or deformations due to installation or shipping shall be repaired, touched up or replaced as required or deemed necessary by the Electrical Engineer at no additional cost to the Owner.

D. Upon final installation of individual luminaires, dirt and debris shall be removed from luminaire enclosures.

3.8 ADJUSTING

A. Occupancy Adjustments: When requested within 12 months of date of Substantial Completion, provide on-site assistance in adjusting the direction of aim of luminaires to suit occupied conditions. Make up to two visits to Project during other-than-normal hours for this purpose. Some of this work may be required during hours of darkness.
   1. During adjustment visits, inspect all luminaires. Replace lamps or luminaires that are defective.
   2. Parts and supplies shall be manufacturer's authorized replacement parts and supplies.
   3. Adjust the aim of luminaires in the presence of the Architect.

END OF SECTION