SECTION 16500 – LIGHTING FIXTURES

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

A. All of the Contract Documents, as listed on the Table of Contents and including General and Supplementary Conditions and Division 1, General Requirements, shall be included in, and made part of, this Section.

1.2 DESCRIPTION OF WORK

A. The work under this Section shall include furnishing and installing interior and exterior lighting fixtures.

B. The work under this Contract shall also include all labor, materials, tools, equipment, transportation, insurance, temporary protection, supervision and incidental items essential for proper installation and operation, even though not specifically mentioned or indicated on the drawings, but which are usually provided or are essential for proper installation and operation of all systems as indicated on the drawings and specified herein.

C. The specifications and drawings describe the minimum requirements that must be met by the Contractor for the installation of all work as shown on the drawings and as specified hereinunder.

D. The following general systems and equipment shall be provided for the new building and as a minimum, but not necessarily limited to the following:

1. Lighting fixtures
2. Lamps
3. Ballasts

1.3 RELATED WORK

A. For work to be included as part of this Section, to be furnished and installed by the Electrical Subcontractor, refer to the Related Work section of Specification Section 16010.

B. Carefully examine all of the Contract Documents, criteria sheets and all other Sections of the specifications for requirements which affect work under this Section, whether or not such work is specifically mentioned in this Section.

1.4 REFERENCES

A. All lighting fixtures including custom fixtures and modified standard products shall comply with all applicable provisions of the following Codes and Trade Standard Publications, and are hereby incorporated into, and made a part of, the Contract Documents:

1.	NFPA 70:	National Electrical Code
2.	UL:	Underwriters' Laboratories
3.	NEC:	National Electrical Code
4.	CBM:	Certified Ballast Manufacturers Association
5.	IES:	Illuminating Engineering Society
6.	ASTM:	American Society for Testing and Materials
7.	ANSI:	American National Standards Institute

1.5 QUALITY ASSURANCE

A. The manufacturers listed within this specification have been preselected for use on this project. No submittal will be accepted from a manufacturer other than specified.

1.6 WARRANTY

A. Attention is directed to provisions of the General Requirements, Supplementary General Requirements, Section 01784 - Warranties and Section 16010 – Electrical Special Conditions regarding guarantees and warranties for the work under this Contract.

1.7 SUBMITTALS

A. Prepare and submit shop drawings in accordance with the requirements hereinbefore specified, and with the Shop Drawings, Product Data and Samples Section 01330 in the manner described therein, modified as noted hereinafter.

B. Submit samples of each fixture type under this Section as may be requested by the Architect for approval. Samples shall be in size and form requested by the Architect, and reasonable to show characteristics, color and finishes of the materials.

C. Submit complete manufacturer's product data of all materials and systems to the Architect for approval, consisting of complete product description and specifications, complete performance test data, complete preparation and installation instructions, and all other pertinent technical data required for complete product and product use information.

D. All shop drawings shall have clearly marked the appropriate specification number or drawing designation for identification of the submittal.

E. Disposition of shop drawings shall not relieve the Contractor from the responsibility for deviations from drawings or specifications unless he has submitted, in writing, a letter itemizing

or calling attention to such deviations at time of submission and secured written approval from the Architect, nor shall such disposition of shop drawings relieve the Contractor from responsibility for errors in shop drawings or schedules.

F. Shop drawings, samples, test data and certificates shall be submitted for approval in accordance with the requirements of the Contract Documents. Fixtures or other materials shall not be shipped, stored or installed into the work unless prior approval has been received, based upon the submittal of shop drawings, samples, catalogue cuts, test data, certificates or other materials submitted for approval. Make modifications to fixtures in accordance with Architect's comments concerning submittals, as a part of the work of this Section.

G. Submittal Schedule

1. Within 30 calendar days after award of General Contract, a List of Intended Manufacturers and estimated fabrication lead times shall be submitted to Architect. "Lead times" shall be measured in weeks, beginning from the manufacturer's receipt of approved shop drawings and release, and ending at shipment. Architect shall approve or disapprove each manufacturer.
2. Within 15 days after Contractor's receipt of Architect's response to the List of Intended Manufacturers, copies of purchase orders and manufacturers' acknowledgements for all fixtures specified, conforming to Architect's responses, shall be forwarded to Architect. The purchase orders and the manufacture acknowledgements need not list prices but shall contain a warranted fabrication lead time, in weeks, as defined above. These fabrication times shall be adequate for the timely completion of the job.
3. Within 30 days after date of manufacturer's acknowledgement of order, Contractor shall forward to Architect complete shop drawings, and/or catalogue cuts for all specified fixtures.
4. Within 15 days after receipt of "approved" or "approved as noted" shop drawings, Contractor shall forward to Architect a warranted shipment date for each specified fixture, as well as forwarding samples, texts, or any outstanding data required for approval.
5. Within 15 days after Contractor's receipt of disapproved shop drawings, revised shop drawings shall be resubmitted to Architect.
6. Contractor shall call to the attention of Architect any submittals that have not been returned to him in a timely manner and that might effect the appropriate delivery of fixtures.

H. Shop Drawings

1. Indicate on shop drawings, materials, finished, metal gauges, overall and detail dimensions, sizes, electrical and mechanical connections, fasteners, welds, joints, end conditions, provisions for the work of others, and similar information. Include pertinent mounting details including hung ceiling construction. Indicate complete details of the fixture, including manufacturer's catalogue numbers for sockets, ballasts, light shields, switches and type of wiring, and targeting and locking devices for adjustable fixtures. Indicate type and extent of approved inert insulating materials to prevent electrolytic corrosion at junctions of dissimilar metals shall be supplemented by additional drawings if information or descriptions listed above are not included in the cuts.

2. Provide shop drawings for each type of lamp specified.
3. Submit independent laboratory photometric data in the directed number of copies and in format as directed by Architect. Photometric data shall be submitted for standard, "off-the-shelf" units, at the time the manufacturer's cuts are submitted. Photometric testing and reporting shall conform to IES procedures.
4. Manufacturer's Catalogue Sheets shall indicate input and load electrical characteristics, ambient temperature rating, noise level rating, mounting methods and UL listing for use with required lamp.
5. Fluorescent fixture manufacturer shall submit (with fixture shop drawing or Catalogue Sheet) thermal test data for the fixture to prove that nuisance tripping of the Class "P" ballast shall not occur when fixture is operating under the following conditions:

    a. Voltage not exceeding 5 percent above nominal 120 or 277 volts.
    b. Room ambient of 77°F (25°C).
    c. Ceiling cavity ambient temperature for recessed installation shall not exceed 113°F (45°C).

1.8 SUBSTITUTIONS

A. No substitutions shall be permitted. The Contractor shall submit one of the fixtures listed for each fixture type as indicated on the lighting fixture schedule.

1.9 COORDINATION

A. The work of this Section shall be coordinated with other work of the Contractor. The placement of all access panels shall be coordinated with all other Trades and with the Architect.

PART 2 - PRODUCTS

2.1 GENERAL

A. Provide materials, equipment, appurtenances and workmanship for the work of this Section conforming to the highest commercial Standards as specified and indicated on the drawings. Make fixture parts and components not specifically identified or indicated on the drawings, of materials most appropriate to their use or function, and resistant to corrosion and to thermal and mechanical stresses encountered in the normal application and function of the fixtures.

B. Provide recessed fixtures that are constructed to be suitable for and compatible with the ceiling, wall or pavement materials and construction in which they shall be installed.

C. All recessed incandescent lighting fixtures shall be provided with thermal cutoff devices which shall conform to the requirements rated for control of incandescent lamps, as indicated by the NEC Article 410-65(c) and as specified by UL.

D. Each and every lighting fixture ballast shall be complete with accessible, individual fuse holder such as Bussman NLR fuse holder or approved equal.

2.2 MARKING OF FIXTURES

A. Plainly mark fixtures equipped with ballasts for operation of rapid start lamps "Use Rapid Start Lamps Only". Similarly, mark other fixtures according to proper lamp type. Clearly mark ballasts that have multi-level outputs as such, and indicate proper terminals for the various outputs. Provide markings that are clear and readily visible to service personnel, but invisible from normal viewing angles when lamps are in place.

2.3 MATERIALS AND FABRICATION

A. Provide fixtures, completely factory assembled, wired, and equipped with necessary sockets, ballasts, wiring, shielding, reflectors, channels, lenses and other parts and appurtenances necessary to complete the fixture installation and deliver to project site ready for installation.

2.4 FINISHES

A. Lighting fixture finishes shall be selected by the Architect. The Architect shall select finishes and indicate the color selections on the shop drawing submittals.

2.5 FIXTURE WIRING

A. Provide wiring channels and wireways free from projections and rough or sharp edges throughout. At points or edges over which conductors shall pass and may be subject to injury or wear, round bush to make a smooth contact surface with the conductors.

B. Install insulated bushings at points of entrance and exit of flexible wiring.

2.6 FLUORESCENT BALLASTS (T8 AND ABOVE)

A. Fluorescent ballasts shall be electronic type and operate lamps at a frequency above 20k Hz with no visible flicker (<5% flicker index).

B. Ballast manufacturer shall have been producing electronic ballasts for at least ten (10) years with a low failure rate.

C. Ballast shall be specifically designed to operate the number and type of lamps for each fixture as indicated on the Lighting Fixture Schedule.

D. Ballasts shall operate at an input frequency of 60 Hz and an input voltage of 108 to 132 (120 volt circuit) or 249 to 305 (277 volt circuit) with no damage to the ballast.

E. Ballasts shall provide transient immunity as specified by ANSI C82.41-1991, Location Category A1.

F. Ballasts shall provide starting sequence consistent with ANSI standard C82.11-1993.

G. Ballasts shall operate as a parallel circuit allowing remaining lamp(s) to maintain full light output if one or more lamps fail.

H. Ballasts shall tolerate sustained open circuit and short circuit output conditions without damage to the ballast.

I. Ballasts shall be UL Listed as Class P, and for use in indoor or Type 1 outdoor applications and shall contain a temperature sensing device that shall switch the ballast off if excessive internal temperature develops.

J. Ballasts shall tolerate operation in ambient temperatures up to 105 degrees F (40 degrees C) without damage.

K. Ballasts shall comply with limits of FCC Part 18, Subpart C Limits for Non-Consumer Equipment for EMI and RFI.

L. Ballasts shall have Power Factor greater than 0.90.

M. Lamp Current Crest Factor (ratio of peak to RMS lamp current) shall be 1.7 or less in accordance with lamp manufacturer's recommendation and ANSI C82.11-1993.

N. Ballast shall have a Ballast Factor between 0.87 and 0.90 per ANSI C82.11-1993.

O. Ballast Efficacy Factor (relative light output per watt consumed) shall be at least 10% greater than CBM certified electromagnetic ballasted system for the same application.

P. Input current Total Harmonic Distortion shall not exceed 10%.

Q. Ballasts shall be fully encapsulated (potted) to ensure maximum thermal and structural integrity and shall contain no PCBs.

R. Ballasts shall not be affected by lamp failure and shall deliver normal lamp life.

S. Operating temperature shall not exceed 60°C at any point on the case during normal operation.

T. Ballasts shall be marked with manufacturer's name, part number, supply voltage, power factor, open circuit voltage, current draw for each lamp type and UL listing.

U. Ballast shall be as manufactured by Osram Sylvania, Magnetek, Universal, Advance, Jefferson or GE.

2.7 FLUORESCENT BALLASTS (T5 AND SMALLER)

A. Fluorescent ballasts shall be electronic type and operate lamps at a frequency above 20k Hz with no visible flicker (<5% flicker index).

B. Ballast manufacturer shall have been producing electronic ballasts for at least ten (10) years with a low failure rate.

C. Ballast shall be specifically designed to operate the number and type of lamps for each fixture as indicated on the Lighting Fixture Schedule.

D. Ballasts shall operate at an input frequency of 60 Hz and an input voltage of 108 to 132 (120 volt circuit) or 249 to 305 (277 volt circuit) with no damage to the ballast.

E. Ballasts shall provide transient immunity as specified by ANSI C82.41-1991, Location Category A1.

F. Ballasts shall provide starting sequence consistent with ANSI standard C82.11-1993.

G. Ballasts shall operate as a parallel circuit allowing remaining lamp(s) to maintain full light output if one or more lamps fail.

H. Ballasts shall tolerate sustained open circuit and short circuit output conditions without damage to the ballast.

I. Ballasts shall be UL Listed as Class P, and for use in indoor or Type 1 outdoor applications and shall contain a temperature sensing device that shall switch the ballast off if excessive internal temperature develops.

J. Ballasts shall tolerate operation in ambient temperatures up to 105 degrees F (40 degrees C) without damage.

K. Ballasts shall comply with limits of FCC Part 18, Subpart C Limits for Non-Consumer Equipment for EMI and RFI.

L. Ballasts shall have Power Factor greater than 0.90.

M. Lamp Current Crest Factor (ratio of peak to RMS lamp current) shall be 1.7 or less in accordance with lamp manufacturer's recommendation and ANSI C82.11-1993.

N. Ballast shall have a Ballast Factor between 0.87 and 0.90 per ANSI C82.11-1993.

O. Ballast Efficacy Factor (relative light output per watt consumed) shall be at least 10% greater than CBM certified electromagnetic ballasted system for the same application.

P. Input current Total Harmonic Distortion shall not exceed 10%.

Q. Ballasts shall be fully encapsulated (potted) to ensure maximum thermal and structural integrity and shall contain no PCBs.

R. Ballasts shall not be affected by lamp failure and shall deliver normal lamp life.

S. Operating temperature shall not exceed 60°C at any point on the case during normal operation.

T. Ballasts shall be marked with manufacturer's name, part number, supply voltage, power factor, open circuit voltage, current draw for each lamp type and UL listing.

U. Electronic ballasts operating T5 or smaller diameter lamps (including linear T5, compact fluorescent twin tube, triple tube or quad tube or T5 compact fluorescent) shall be high power factor IC type with integral end-of-lamp-life detection circuitry.

V. Ballast shall be as manufactured by Osram Sylvania, Magnetek, Universal, Advance, Jefferson or GE.

2.8 HID LAMP BALLASTS

A. High intensity discharge lamp ballasts shall be core and coil ballasts designed in accordance with all applicable ANSI specifications including ANSI C84.2

B. The core and coil ballast shall be designed with class "H" (180 degrees C) or higher insulation system and by 100% solid based resin impregnated.

C. All coils shall be precision wound.

D. Core and coil ballasts shall be designed to operate at least 180 cycles of 12 hours on and 12 hours off, with the lamp circuit in an open or short-circuited condition and without undue reduction in ballast life.

E. Core and coil ballast and starter combinations shall be designed to provide reliable lamp starting down to -40 degrees C for high pressure sodium and -20 degrees C for metal halide lamps.

F. High intensity discharge lamp ballasts shall have an operating power factor of 0.90 or higher.

G. Capacitors shall be oil filled with self-contained internal protective device and bleeder resistor.

H. Capacitors shall be housed in corrosion-resistant steel cans and contain 0.25" quick disconnect terminals.

I. Starters shall be epoxy filled with either a plastic or aluminum external housing.

J. Starters shall be designed to provide 6 months of lamp open circuit operation without failure.

K. All high intensity density lamp ballasts shall be UL listed per UL 1029.

L. Ballast shall be as manufactured by Osram Sylvania, Magnetek, Universal, Advance, Jefferson or GE.

2.9 LAMPHOLDERS

A. Provide incandescent and HID lamp sockets with porcelain housings over copper screw shells, with medium base sockets rated at 660 watt. Plastic or metal sheet sockets are not approved.

B. Provide fluorescent fixture sockets that are white, of heat resistant plastic and rated at 660 watt. Fluorescent lamp sockets operating with an open circuit voltage in excess of 300 volts shall be of the safety type which open the supply circuit when the lamp is removed from the sockets.

C. Rigidly and securely attach lampholding sockets to the fixture enclosure or husk.

D. Provide sockets suitable for specified lamps, and set to position the lamps in optically correct spacing and relationship to lenses, reflectors, filters, and baffles.

E. Where fluorescent lamps are to be used "bare" without diffusers or lenses, provide at least (2) approved lamp retaining clips per fluorescent lamp for safety, and wire grounds over lamp housing.

2.10 INCANDESCENT LAMPS

A. Incandescent lamps shall have ratings as indicated on the lighting fixture schedule.

B. Lamps shall be as manufactured by Osram Sylvania, General Electric or Phillips Lighting.

2.11 FLUORESCENT LAMPS

A. Fluorescent lamps shall be Osram Sylvania Octron type, Philips "Octolume" or General Electric "Trimline", with ratings and lamp color as indicated on the lighting fixture schedule.

B. Compact fluorescent lamps shall have ratings as indicated on the lighting fixture schedule.

C. Fluorescent lamps shall have a color temperature of 3,500 degrees Kelvin. Fluorescent lamps used in operating rooms shall have a color temperature of 5,000 degrees Kelvin. Compact fluorescent lamps shall have a minimum color rendition index (CRI) of 82. Biax fluorescent lamps and T8 fluorescent lamps shall have a minimum CRI of 85. Fluorescent lamps used in operating rooms shall have a minimum CRI of 90.

D. Lamps shall be as manufactured by Osram Sylvania, General Electric or Phillips Lighting.

2.12 HIGH INTENSITY DISCHARGE LAMPS

A. High intensity discharge lamps shall have ratings as indicated on the lighting fixture schedule.

B. Lamps shall be as manufactured by Osram Sylvania, General Electric or Phillips Lighting.

2.13 LENSES/FACEPLATES/TRIM

A. Where plastic lenses are indicated provide lenses of virgin methyl methacrylate, unless otherwise indicated.

B. Make lenses, louvers, or other light diffusing elements contained in frames removable, but positively held within the frames so that hinging or other motion of the frame shall not cause the diffusing element to drop out.

C. Provide faceplates on incandescent recessed fixtures which open for access to the interior of the fixture, serve as a ceiling trim, and are positively held to the fixture body by adjustable means that permit the faceplate to be drawn up to the ceiling as tight as necessary to ensure complete contact of faceplate with ceiling surrounding the fixture.

D. All recessed downlights in painted dry wall ceilings or acoustic tile ceilings shall have self-trimming reflectors with white flanges. All recessed downlights in perforated metal ceilings shall have self-trimming reflectors with no paint trim.

E. Refer to architectural plans to match trim styles. Coordinate trim styles with ceiling type.

2.14 EXTERIOR FIXTURES

A. Provide fixtures designed and manufactured specifically for outdoor service. Make components, including nuts, bolts, rivets, springs, and similar parts, of materials of effective corrosion resistance, or of materials which have been subjected to finishing treatment which shall ensure such resistance.

B. Provide fixtures for use outdoors or in areas designated as damp locations, which are suitably and effectively gasketed to prevent access of moisture into electrical components or enclosing diffusers, lenses or globes.

C. Provide metal parts of fixtures for use in outdoor or damp locations which are specified as requiring painting with suitable weather and moisture resisting qualities equal to epoxy-based coatings.

D. Provide anodized aluminum for aluminum parts of exterior fixtures which are not specified as requiring a painted finish.

2.15 LIGHTING FIXTURES

A. Refer to lighting fixture schedule on the drawings.

PART 3 - EXECUTION

3.1 COOPERATION AND WORK PROGRESS

A. The Electrical work shall be carried on under the usual construction conditions, in conjunction with all other work at the site. The Electrical Subcontractor shall cooperate with the Architect, General Contractor, all other Subcontractors and equipment suppliers working at the site. The Electrical Subcontractor shall coordinate the work and proceed in a manner so as not to delay the progress of the project.

B. The Electrical Subcontractor shall coordinate his work with the progress of the building and other Trades so that he will complete his work as soon as conditions permit and such that interruptions of the building functions will be at a minimum. Any overtime hours worked or additional costs incurred due to lack of or improper coordination with other Trades or the Owner by the Electrical Subcontractor, shall be assumed by him without any additional cost to the Owner.

C. The Electrical Subcontractor shall furnish information on all equipment that is furnished under this Section but installed under another Section to the installing Subcontractor as specified herein.

D. The Electrical Subcontractor shall provide all materials, equipment and workmanship to provide for adequate protection of all electrical equipment during the course of construction of the project. This shall also include protection from moisture and all foreign matter. The Electrical Subcontractor shall also be responsible for damage which he causes to the work of other Trades, and he shall remedy such injury at his own expense.

E. Waste materials shall be removed promptly from the premises. All material and equipment stored on the premises shall be kept in a neat and orderly fashion. Material or equipment shall not be stored where exposed to the weather. The Electrical Subcontractor shall be responsible for the security, safekeeping and damages, including acts of vandalism, of all material and equipment stored at the job site.

F. The Electrical Subcontractor shall be responsible for unloading all electrical equipment and materials delivered to the site. This shall also include all large and heavy items or equipment which require hoisting. Consult with the General Contractor for hoisting/crane requirements. During construction of the building, the Electrical Subcontractor shall provide additional protection against moisture, dust accumulation and physical damage of the main service and distribution equipment. This shall include furnishing and installing temporary heaters within

these units, as approved, to evaporate excessive moisture and ventilate it from the room, as may be required.

G. It shall be the responsibility of the Electrical Subcontractor to coordinate the delivery of the electrical equipment to the project prior to the time installation of equipment will be required; but he shall also make sure such equipment is not delivered too far in advance of such required installation, to ensure that possible damage and deterioration of such equipment will not occur. Such equipment stored for an excessively long period of time (as determined in the opinion of the Architect) on the project site prior to installation may be subject to rejection by the Architect.

H. The Electrical Subcontractor shall erect and maintain, at all times, necessary safeguards for the protection of life and property of the Owner, Workmen, Staff and the Public.

I. Prior to installation, the Electrical Subcontractor has the responsibility to coordinate the exact mounting arrangement and location of electrical equipment to allow proper space requirements as indicated in the NEC. Particular attention shall be given in the field to group installations. If it is questionable that sufficient space, conflict with the work of other Subcontractors, architectural or structural obstructions will result in an arrangement which will prevent proper access, operation or maintenance of the indicated equipment, the Electrical Subcontractor shall immediately notify the Contractor and not proceed with this part of the Contract work until definite instructions have been given to him by the Architect.

3.2 INSTALLATION

A. General

1. Unless specifically noted or indicated otherwise, all equipment and material specified in Part 2 of this specification or indicated on the drawings shall be installed under this Contract whether or not specifically itemized herein. This Section covers particular installation methods and requirements peculiar to certain items and classes or material and equipment.
2. The Electrical Subcontractor shall obtain detailed information from manufacturers of equipment provided under Part 2 of this specification as to proper methods of installation.
3. The Electrical Subcontractor shall obtain final roughing dimensions and other information as needed for complete installation of items furnished under other Sections or furnished by the Owner.
4. The Electrical Subcontractor shall keep fully informed of size, shape and position of openings required for material and equipment provided under this and other Sections. Ensure that openings required for work of this Section are coordinated with work of other Sections. Provide cutting and patching as necessary.
5. All miscellaneous hardware and support accessories, including support rods, nuts, bolts, screws and other such items, shall be of a galvanized or cadmium plated finish or of another approved rust-inhibiting coating.
6. Throughout this Section where reference is made to steel channel supports, it shall be understood to mean that the minimum size shall be 1 5/8" mild strip steel with minimum wall thickness of 0.105", similar to Unistrut P1000 or equal products manufactured by

Kindorf or Husky Products Co. Where reference to channel supports is made under "Lighting Fixtures" paragraph of this Section, the maximum length of span shall be 10'-0". If longer spans are required, the size and wall thickness of the steel channel support shall be as specifically approved by the Engineer.

B. Lighting Fixtures

1. Furnish, assemble, hang and connect all lighting fixtures. Lighting fixtures shall be as indicated on the drawings.
2. Install each fixture properly and safely. Provide hangers, rods, mounting brackets, supports, frames, yokes, support bars and any other equipment required for a complete installation. Refer to Section 16050 for Hangers and Supports.
3. Lay-in recessed fixtures in grid type ceilings shall be supported from the underside of roof or floor slab, and utilize hangers, as indicated in Section 16050, with attachments to building construction independent of other systems. All fluorescent fixtures shall have a minimum of (2) hangers supports and all incandescent fixtures shall have at least one hanger support. Hanger wire will not be acceptable.
4. All lighting fixtures shall be supported from the slab above and shall not be suspended from ducts, piping, equipment, ceiling support system, etc.
5. Where continuous rows of lighting fixtures are installed (pendant mounted), the Electrical Contractor shall furnish and install appropriate mounting channels to properly align fixtures. Use Kindorf or Unistrut channels.
6. Before ordering fixtures, the Electrical Contractor shall verify with the General Contractor the type of ceilings which shall be used in the various spaces.
7. Coordinate fixture locations and mounting heights with Architectural plans, reflected ceiling plans and other reference data prior to installation.
8. Do not scale electrical drawings for exact location of the lighting fixtures. Consult the architectural reflected ceiling plans for the proper locations of lighting fixtures.
9. Prior to fabrication and submittal of shop drawings, check for adequate headroom and non-interference with other equipment such as ducts, pipes or openings.
10. Pendant or surface mounted fixtures shall be provided with required mounting devices and accessories, including hickeys, stud extensions, ball aligners, canopies and stems. Locations of fixtures in mechanical areas shall be coordinated with the Mechanical Contractor. Mounting stems of pendant fixtures shall be of the correct length to uniformly maintain the fixture heights shown on the drawings. Variation in mounting individual fixtures shall not exceed 1/4 inch. Height shall not vary more than 1/2 inch from the floor mounting height shown on the drawings. Fixtures hung in continuous runs shall be installed absolutely level and in line with each other. Hanging devices shall comply with Code requirements. Use single stem hangers (double stem hangers shall not be acceptable). Threaded rods shall be used to support lighting fixtures in those spaces where no other means of support is attainable, and only if fixtures are installed absolutely level with no looseness for movement, and only if approved by Code.
11. Rigidly align continuous rows of lighting fixtures for true in-line appearance, subject to Architect's approval.
12. Install pendant lighting fixtures plumb and at a height from the floor as specified or indicated on the drawings. In cases where conditions make this impractical, refer to the Architect and install as directed. Use ball aligners and canopies on pendant fixtures unless noted otherwise.

13. Do not install fixtures and/or parts such as finishing plates and trims for recessed fixtures until all plastering and painting that may mar fittings finish has been completed.
14. Housings shall be rigidly installed and adjusted to a neat flush fit with the ceiling or other finished mounting surface.
15. The housings of recessed lighting fixtures shall be adequately protected during installation.
16. Install reflector cones, baffles, aperture plates, light controlling element for air handling fixtures, and decorative elements after completion of ceiling tiles, painting and general cleanup.
17. Replace blemished, damaged or unsatisfactory fixtures as directed.
18. Exterior poles, bases and any other fixture or fixture components with scratched or damaged finish shall be repainted to match specified color. Pole mounted fixtures shall be provided with inline fuses located in base.
19. Any lamps, ballasts, reflectors, lens, diffusers, side panels or other parts damaged prior to the final inspection shall be replaced at no expense to the Owner.
20. At time of final inspection, all fixtures and equipment shall be fully lamped, and shall be complete with required lenses or diffusers, reflectors, side panels, louvers or other components necessary.
21. Each lighting fixture shall be packaged with complete instructions and illustrations showing how to install. Install lighting fixtures in strict conformance with manufacturer's recommendation and instructions.
22. Provide fixtures constructed, wired and installed in compliance with the current edition of applicable City, State and National Codes. Provide fixtures conforming to UL Standards, and to provisions of applicable Codes which exceed those Standards. In addition, provide fixtures which conform to additional Regulations necessary to obtain approval for use of specified fixtures in locations shown. Use only electrical components UL listed.
23. Particular attention is called to Article 410 of the NEC. Provide only fixtures that meet these requirements, as interpreted by local agencies. As manufacturers' catalogue numbers may not include thermal protection devices, it is Contractor's responsibility to coordinate the fixture provided with the ceiling construction in accordance with Local Code enforcement practice.
24. Mounting of all lighting fixtures shall conform to seismic requirements.

3.3 MATERIALS AND WORKMANSHIP

A. All materials and equipment shall be new and unused and shall meet requirements of the latest Standards of NEMA, UL, IPCEA, ANSI and IEEE. Equipment shall have components required or recommended by OSHA, applicable NFPA documents and shall be UL listed and labeled.

B. Despite references in the specifications or on the drawings to materials or pieces of equipment by name, make or catalog number, such references shall be interpreted as establishing standards of quality for materials and performance.

C. Finish of materials, components and equipment shall not be less than Industry good practice. When material or equipment is visible or subject to corrosive or atmospheric conditions, the finish shall be as approved by the Architect.

D. Provide proper access to material or equipment that requires inspection, replacement, repair or service. If proper access cannot be provided, confer with the Architect as to the best method of approach to minimize effects of reduced access.

E. All work shall be installed in a neat and workmanlike manner and shall be done in accordance with all Local and State Codes.

F. The Owner will not be responsible for material, equipment or the installation of same before testing and acceptance.

END OF SECTION