SECTION 16500

LIGHTING

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

A. The work of this section consists of providing labor, materials, tools, appliances and miscellaneous accessories associated with lighting fixture work as indicated herein and on the Drawings and schedules.

B. Type: The types of lighting fixtures required for the project include the following:

1. Fluorescent-type fixtures.
2. High Intensity Discharge (HID) type fixtures.
3. Incandescent type fixtures.

C. Applications of lighting fixtures required for project include the following:

1. General interior lighting.
2. Supplementary lighting.
3. Task lighting.
4. Emergency lighting.
5. Exterior lighting.

1.2 RELATED DOCUMENTS

A. Drawings.

B. General provisions of Contract, including General and Supplementary Conditions.

C. Division 01 - Specification Sections.

D. Section 09900 - Painting.

E. Section 16010 - General Electrical Provisions.

1.3 FIXTURES: Furnish, assemble, install, and wire up complete, all lighting fixtures including those for general illumination, exit sign, and emergency lighting, and exterior lighting. Fixtures shall be complete with lamps, lamp holders, and all necessary accessories. Fixtures shall bear the Underwriters' Laboratories, Inc. label of approval and be purchased, wired, and installed in accordance with applicable codes.

PART 2 - PRODUCTS

2.1 FIXTURES

A. General: All fixtures shall be as indicated and scheduled on the Drawings. The omission of a type or quantity in the fixtures schedule shown on the Drawings will not relieve the Contractor of the responsibility for furnishing all fixtures indicated on the Drawings.

B. Provide lighting fixtures, of the size, type, and rating indicated, complete with, but not necessarily limited to, lamps, lampholders, reflectors, ballasts, starters, and wiring.

C. Fixture Types:

1. Fluorescent Fixtures:

   a. Provide fluorescent fixtures complete with lamps, ballasts, and appropriate lamp sockets.
   b. Where lenses are specified, provide extruded virgin acrylic, prismatic type, minimum 0.125" thick, unless otherwise noted.
   c. For other than lay-in type ceilings, recess fluorescent fixtures shall be flanged type.
   d. Fluorescent fixtures in continuous rows shall be supplied with all fixture couplings, chase nipples, and other accessories recommended by the manufacturer for continuous row installation. Proper fixture alignment shall be maintained throughout. Fixtures which cannot be properly aligned shall be rejected.

2. HID Fixtures:

   a. Provide HID fixtures complete with lamps, ballasts, and all other necessary components for proper installation and support.
   b. Provide a shield below the lamp to prevent glass, if a lamp breaks, from falling to the floor.

3. Incandescent Fixtures: Provide incandescent fixtures complete with lamps. Provide recessed incandescent fixtures with trim rings compatible with the ceiling material where fixture is to be installed.

4. Exit Signs: The exit lighting fixtures shall meet the requirements of Federal, State, and Local codes. Exit signs shall be of the LED type and have the word "EXIT" printed in red letters at least 6" in height. The letters and associated arrows shall be of red translucent material placed on an opaque background. Each signs shall be equipped with a minimum of two lamps and designed for operations on two separate circuits. Battery power units shall be totally self-contained such that

no external equipment is required for the unit to perform its emergency function. The unit shall include maintenance free batteries, charging unit, transfer relay, indicator lamps and test switch. Field paint exit fixtures as noted on drawings.

2.3 BALLASTS

A. Fluorescent Electronic Type:

1. The ballast shall be physically interchangeable with a standard core and coil electromagnetic ballast. Ballast shall be provided with integral leads, color coded to ANSI standard C82.11 (latest version).

2. The "High Frequency" electronic ballast shall operate lamps at a frequency of 20 kHz or higher without visible flicker.

   a. The electronic ballast's input current shall have Total Harmonic Distortion (THD) of less than 20% when used with primary lamp.
   b. The electronic ballast shall have a Power Factor greater than 98% when used with primary lamp.
   c. The electronic ballast shall have Lamp Current Crest Factor of less than 1.7, in accordance with lamp manufacturers' recommendations and ANSI C82.11.
   d. The electronic ballast shall support a sustained short to ground or open circuit of any output leads without damage to the ballast.
   e. The electronic ballast shall have an audible noise rating of Class A or better.

3. Ballast shall meet the requirements of the Federal Communications Commission Rules and Regulations, Part 18, for non-consumer equipment.

   a. The electronic ballast shall meet ANSI C82.11 standards regarding harmonic distortion.
   b. Ballast shall meet ANSI C62.41 Cat. A for transient protection.
   c. The electronic ballast shall comply with all applicable state and federal efficiency standards.
   d. The electronic ballast shall be Underwriters' Laboratories (UL) listed (Class P) and CSA certified where applicable.

4. The electronic ballast shall be specified Advance or equal.

   a. The electronic ballast shall not contain Polychlorinated Biphenyls (PCB's).
   b. The electronic ballast shall carry a five-year warranty.
   c. Manufacturer shall be a full-line ballast manufacturer with a 10-year history of producing electronic ballasts for the North American Market.

B. High-Intensity Discharge Type: Ballast for HID lamps shall be high power factor, constant wattage or constant wattage auto-transformer, low noise level, a -20oF

temperature rating, and shall be furnished by the manufacturer of each type or particular lighting fixture specified.

C. Ballasts shall be universal type for use on 120/208/277-volt systems. For 120 volt use, ballasts shall be suitable and guaranteed for a voltage range of 100 to 130 volts; for 208 volt use, ballasts shall be suitable and guaranteed for a voltage range of 195 to 230 volts; for 277-volt use, ballasts shall be suitable and guaranteed for a voltage range of 225 to 290 volts.

2.4 LAMPS

A. Lamps shall be of the wattage, type, color, and reflector lamps with type of beams indicated, as shown, and scheduled. Provide extended service lamps that are inside frosted.

B. Fluorescent lamps shall be 3500°K, unless noted otherwise.

C. HID lamps shall be clear or coated type as indicated on the Drawings and/or as required by the manufacturer of the respective fixtures.

D. Incandescent lamps shall be inside-frosted, 130 volts unless indicated otherwise.

2.5 LIGHTING POLES/STANDARDS: Poles used for the support of lighting fixtures shall be provided with an accessible handhole, not less than 2 inches x 4 inches, having a raintight cover to supply access to the supply raceway or cable termination within the pole or pole base. For poles 20 feet or less in height above grade, handhole may be omitted if pole is provided with a hinged base. Comply with NEC 410-15.

PART 3 - EXECUTION

3.1 INSTALLATION OF LIGHTING FIXTURES

A. General: Install lighting fixtures of the types indicated, where shown, and at the indicated heights in accordance with the fixture manufacturer's written instructions and recognized industry practices to ensure that the fixtures comply with the requirements and serve the intended purposes. Fixtures shall exactly fit the type of ceiling system scheduled for the space.

B. Provide adequate and safe protection for fixtures and at completion of the work they shall be made clean and free of all foreign material, dust, etc.

C. Furnish and set all inserts, anchors, studs, and hangers for the support of lighting fixtures and respective equipment, and make all necessary adjustments required therein.

D. Verify location and spacing of fixtures with Reflected Ceiling Plans and other reference data before installation. Coordinate space conditions; including head room clearances, and interferences with ceiling components, such as ducts, openings, beams and piping, prior to installation.

E. In acoustical tile ceilings with concealed mechanical suspension system and in gypboard or plaster ceilings, recessed troffers shall be flanged type fixtures. In acoustical tile ceilings with exposed mechanical suspension systems, troffers shall be lay-in type.

F. Lamping-Up: Furnish and install fluorescent, H.I.D. and incandescent lamps in all lighting fixtures.

G. Standards: Comply with NEMA standards, applicable requirements of the NEC pertaining to installation of interior lighting fixtures, and with applicable portions of the NECA's "Standard of Installation.

H. Attachment: Fasten fixtures securely to the indicated structural support members of the building. Provide separate supports for all recessed ceiling-mounted HID lighting fixtures. Check to ensure that solid pendant fixtures are plumb.

I. For any type ceiling provide sufficient support for fixtures, either arrange with other subcontractors to strengthen ceiling or support fixtures from structure above independently of ceiling. **Regardless of whether or not the ceiling can support the fixtures, provide securing wires on fixture to structure. Provide a minimum of two securing wires to 2x4, 2x2, etc. NOTE: Securing wires are not the same as support wires. Securing wires are for preventing a fixture from falling into a space if the ceiling fails under a fire situation.**

J. Fixtures supported by ceiling framing members shall be securely fastened thereto by mechanical means, such as bolts, screws, or rivets. Clips designed and approved for the purpose shall be permitted.

K. Suspended fluorescent fixtures in continuous rows shall have one stem at the beginning of the row, one stem at each channel joint, and one stem at the end of the row.

L. Fluorescent fixtures mounted individually on stems shall each have two single stem hangers. Fluorescent fixtures individually surface mounted shall be supported at both ends.

M. Fixtures to be installed in or on painted ceilings and/or walls shall not be installed until painting is completed. Fixtures installed with paint applied over factory finishes will be rejected.

N. Thermal insulation shall not be installed within 24 inches of the top or within 3 inches of the sides of a recessed fixture enclosure, wiring compartment, or ballast unless labeled for the purpose. Work of this section includes advising other trades of this requirement so that proper clearances are maintained.

O. Articles 410-13 and 410-76 of the National Electrical Code regarding installation of lighting fixtures in combustible ceilings or walls shall apply.

3.2 SHIPPING REQUIREMENTS

A. It shall be the Contractor's responsibility to coordinate and evaluate the shipping schedule for fixtures as required by the progress of the job.

B. The Owner will not accept payment responsibility for fixtures scheduled, and delivered out of construction sequence at an earlier or later time than reasonably required by job progress.

C. Fixtures shall be in first class condition after installation. The lens surface shall be cleaned, if required. Fixtures with rust or damaged lenses shall be replaced at no cost to the Owner. Louvers for parabolic type fixtures shall be shipped enclosed in polyethylene bag for maximum protection.

3.3 ADJUST AND CLEAN

A. Clean interior lighting fixtures of dirt and debris upon completion of installation.

B. Protect installed fixtures from damage during remainder of construction period.

3.4 FIELD QUALITY CONTROL

A. Upon completion of installation of lighting fixtures, and after building circuitry has been energized, apply electrical energy to demonstrate capability and compliance with requirements. Where possible, correct malfunctioning units at site, then retest to demonstrate compliance; otherwise, remove and replace with new units, and proceed with retesting.

B. Replace defective and burned out lamps for period of 6 months following the time of Substantial Completion.

C. At the time of Substantial Completion, replace lamps in interior lighting fixtures which are observed to be noticeable dimmed after Contractor's use and testing, as judged by Architect/Engineer. Furnish stock or replacement lamps amounting to 15% (but not less than one lamp in each case) of each type and size lamp used in each type fixture. Deliver replacement stock as directed to Owner's storage space.

D. Refer to Division-1 sections for the replacement/restoration of lamps in interior lighting fixtures, where used for temporary lighting prior to time of Substantial Completion.

3.5 INSTRUCTION: Provide minimum of 2-1 hour instruction sessions for Owner personnel for programming procedures for time switch.

3.6 GROUNDING: Provide tight equipment grounding connections for each interior lighting fixture installation where indicated.

END OF SECTION