

SECTION 16500

LIGHTING

PART 1 - GENERAL

1.1 SUMMARY

A. The purpose of this section is to describe the general requirements for building lighting.

1.2 SUBMITTALS

A. General: Design drawings, data, and calculations at various stages of completion shall be submitted for each phase of the plan review process. The specific submittal requirements for each phase are outlined below.

B. Schematic Design: Cost-effective day-lighting strategies, task lighting, lighting controls, and the impact of lighting systems on HVAC systems shall be an integral part of the building's design. Different day-lighting and artificial lighting design approaches shall be evaluated for their program needs and cost effectiveness.

C. Design Development: The submittal shall include an economic analyses considering installed costs, energy use, lighting efficiency, maintenance costs, lamp life, footcandle levels, and watts-per-square foot connected load. Manufacturer's literature and photometric data for each fixture shall be provided. Fixture schedules shall be included along with estimates of fixture quantities and watts per fixture.

D. 50% Construction Documents: Manufacturer's literature and specifications for all controls shall be provided. An economic and energy analysis of the control scheme shall be provided along with specific details of the entire system.

E. 95% Construction Documents: Complete design with all details on lighting system, economic and energy analysis.

1.3 GENERAL DESIGN CONSIDERATIONS

A. Economic Analysis: Life Cycle Cost Analysis

B. Interior lighting shall be designed to provide illumination to support the activities for which the building is intended.

1. No luminaries, circuiting, or switching shall be considered final until accepted by the Owner at the Schematic Design phase, especially:

a. Foot-candle requirements by type of space

- b. Appropriate light source technology: fluorescent vs incandescent, etc.
  - c. Control Strategies (circuiting, switching, timers, Energy Management Systems)
  - d. Access for lamp and ballast replacement.
  - e. Classroom needs (include DC Instructional Services rep)
  - f. Breakers serving lighting shall be located on the same floor which they are serving.
2. Luminaires shall be commercially available, standard models. Custom designed/built luminaires shall not be used when standard models similar in appearance and performance are available.
  3. Incandescent lighting is subject to specific approval by the Owner
  4. Use daylighting, with appropriate controls, where practical and where required by CAC, Title-24
  5. In general the lighting levels shall be in accordance with the IES guidelines for specific tasks and locations. In addition, the lighting design shall comply with CAC Title-24, Energy Standards and shall include Title-24 documents.
  6. Lighting equipment shall be selected so as to insure maintainability. The placement of lighting luminaires shall be made to allow for lamp replacement. Where lamp replacement will reasonably require the use of special equipment such as telescoping poles or lowering devices, these shall be specified to be supplied as part of the project. Placement of lighting above stairways and atriums should be avoided unless convenient relamping provisions are included. Placement of luminaires in locations that require scaffolding or manlifts for relamping is not acceptable.
  7. Fluorescent luminaires shall utilize T-5, T-8 or compact fluorescent lamps.
  8. Emergency lighting systems where required in large classrooms and places of assembly shall consist of evenly spaced luminaires, powered from an emergency generator, central inverter or approved unit equipment, that provides Code compliant illumination of the means of egress.
- C. Task/Ambient Lighting: Designers shall investigate a task/ambient lighting layout- a non-uniform lighting pattern, highlighting task locations, while providing a lower level of general illumination for the space. Either the relocation of lighting equipment when tasks are relocated within a space, or an overall lighting system with adequate switching for flexibility of task arrangements shall be considered.
- D. Daylighting: Designers shall take advantage of natural daylight to replace or supplement artificial lighting. Daylighting aspects shall be considered an integral part of the design

and shall be addressed at the conceptual stage of the design process. Control devices such as blinds, diffusers, and light shelves shall be utilized to project light into the space and to control brightness and glare. Where possible, skylights and clerestories shall be considered.

E. Controls:

1. Designers shall consider and design for control schemes to limit the unnecessary operation of artificial lighting. These include:
  - a. Properly placed and accessible manual switching
  - b. Occupancy sensors
  - c. Dimming controls
  - d. Photo-electric cells for outside lighting
  - e. Electronic time clocks
  - f. Central programmable microprocessor-based lighting control systems.
2. Where natural day-lighting is present, artificial lighting systems shall be controlled to eliminate unnecessary illumination. Controls shall be capable of dimming or turning off lights completely. Where lights are dimmed in response to natural light, a minimum of two (20 steps of reduction shall be utilized:
  - a. Fifty percent (50%)
  - b. One hundred percent (100%)Lighting circuits shall be arranged to facilitate localized control. In all areas where effective use may be made of natural light, lighting circuits shall be arranged so that units in areas where natural light is concurrently available are controlled together. Areas where natural light is not available concurrently shall be controlled separately.

F. Surface Reflectivity:

1. Coordinate with the Architect so that proper surface reflectivity is incorporated in the design.

G. Exterior Building Lighting: Designers shall give priority to the most efficient HID sources for lighting larger areas. Consideration shall be given to existing outdoor illumination, so as to avoid unnecessary lighting.

1. Inverters or other special equipment may be required for outdoor egress lighting.

H. New Energy-Efficient Lighting Products: The Hospital and School of Medicine wishes to encourage the use of the most cost-effective, lighting products consistent with program needs and Title-24 requirements. All products shall have established reliability, maintenance and performance records.

- I. Valence Lighting: Many valence lighting designs are open from above and thus allow combustible materials such as paper and cups to be tossed into the fixtures, creating a fire hazard. Where such conditions exist, lighting ballasts shall be shielded such that combustible materials cannot come in contact with the not surfaces of the ballasts.

## PART 2 - PRODUCTS

### 2.1 LAMPS

- A. General: Priority shall be given to the use of high efficiency light sources.
- B. Incandescent: Incandescent sources shall be used rarely and only when no energy efficient alternatives exist. (MR16 incandescent lamps have a short life and adversely affect Title-24 compliance).
- C. Fluorescent: 32-watt 4-foot F-32 T8 lamps, color temperature 4100K, minimum color rendering index (CRI) of 81, form Phillips, Osram/Sylvania, GE, or approved equal, shall be considered the standard fluorescent lamp. For standardization, 4-foot lamps shall be used wherever possible. Recessed “can” style fixtures shall use compact fluorescent lamps with built-in high-powered electronic ballasts (no incandescent Edison-type bases shall be allowed).
- D. High Intensity Discharge (HID): For each category of HID lamp required (metal halide, or high pressure sodium), all lamps within this category shall be of the same manufacturer. HID lamps installed in open-bottom down-light fixtures shall be self-extinguishing types wherein the current to the arc tube is interrupted in the event that the lamp envelope is broken. The concerns of start-up and re-strike time of HID Sources must be addressed and resolved before interior use of these sources is adopted.
- F. Ballasts shall operate at high frequency (>20kHz) and shall e of the rapid start type with ballast factor of 0.85 – 1.0; ballast shall have a power factor >0.90 and current of <20% with low starting inrush current.

Ballasts shall be UL listed and labeled, meet ANSI requirements, and be certified for compliance with CAC, Title-24.

Suggested Manufactures: Advance, Magne Tek, Oshram/Sylvania.

### 2.2 FIXTURES

- A. Interior: Designers are encouraged to use fixtures with a coefficient of utilization (CU) greater than 0.70 for a room cavity ratio (RCR) of one (1.0). Fixtures shall be easy to clean and relamp, and shall have a low dirt accumulation rate. Lenses (where used) shall be one-hundred percent (100%) virgin acrylic or lexan. Parabolic-type reflector fixtures (where used) shall have minimum three inch (3”) cubes.

- B. Exterior: All exterior damp and wet location fixtures shall be gasketed and made of aluminum or a non-corrosive material. Recessed stairway fixtures and fixtures providing decorative lighting only shall be avoided.

### 2.3 EMERGENCY LIGHTING

- A. Emergency Lighting Systems: For projects where an emergency diesel generator is not available for emergency lighting systems, the following shall be the system of choice.
  - 1. Remote-powered emergency lighting system for egress path and exit lighting shall be a central inverter system.
  - 2. Remote-powered systems shall be equipped with eighty percent (80%) low voltage cutout protection.
  - 3. Remote-powered egress path lighting system shall be central inverter systems equipped with fluorescent lamps.
  - 4. Acceptable Manufacturers:
- B. Battery ballast units are not allowed.
- C. Exit Signs: Exit signs shall be self-powered LED's type, have 120/277 VAC, 60 Hz field selectable connections and be provided with 12V nickel-cadmium batteries and self diagnostic functions. The electrical system shall be protected from surges, over voltage and brownout. The exit signs shall be provided with self-diagnostic capabilities that indicates the condition of the battery, battery charger, transformer, self powered lamps and lamp circuit. The exit signs shall be supplied, with universal mounting for top. Side and rear mount and interchangeable single or dual faces with green letter with black trim and tampered proof LED cover. Words on the sign shall be in block letters six inches in height with a stroke of not less than  $\frac{3}{4}$  inch. Exit signs shall have the option of providing directional arrows. Housing construction to be white textured reinforced molded polycarbonate materials resistant to scratches and UV radiation. The signs shall have a 25 years warranty on the electronic components, 80 years on the LED's and a 10 years warranty on the nickel-cadmium batteries. The signs shall meet UL and UBL standards. Radioactive or self-illuminating exit lights are allowed. Acceptable manufactures are Sure-lite and Dual lite.
- D. Light Fixtures located in hard ceilings must have ballasts which are accessible/maintainable or must be provided with an access panel.

END OF SECTION