

Modify Section 26 50 00 per the following instructions:

1. Changes are shown in **red**, using “Track Changes” function
2. Deletions are shown **struck through**
3. Additions are **underlined**
4. The remainder of section is unchanged.

Section affected:

## 26 50 00 LIGHTING

### .01 General

- A. Design shall follow PSU AD64 Energy Conservation Policy.

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## 26 51 00 INTERIOR LIGHTING

### .01 Lighting Design

A. Minimize the use of different lamp styles and wattages. Maximize the use of the 48 inch T8 lamp as this source has the best combination of efficiency (about 100 lumens/watt), life (exceeding 50,000 hours for major manufacturers), and low cost. The use of this lamp will save energy, reduce material sent to recycling ~~landfills~~, decrease maintenance costs, and save money on lamp replacements.

A-B. Investigate the use of LED luminaires as a replacement to linear fluorescent. Once dimming/daylight harvesting is added to the design, LED becomes a cost-competitive and preferable source. This is due to extending the diode life and LED's better native dimming capability.

B-C. The professional shall submit two (2) copies of computer generated point-by-point calculations of most interior spaces to Engineering Services for review. The use of certain “typical” rooms shall be acceptable except when the amount of fenestration or the room orientation changes. Show calculations for each space without daylight contribution as well as with daylight contribution and lighting controls. Point levels shall be legible shown on a scale drawing. All pertinent calculation parameters shall be indicated and highlighted where non-IES compliant. Engineering Services will provide direction and variance where deemed adequate. Utilize AGI-32 full calculation mode or similar program, as approved by Engineering Services.

C-D. The Illuminating Engineers Society Lighting Handbook, current edition, shall be used as a standard for lighting levels. Provide a spreadsheet showing all room names and numbers along with target illumination levels. For television studios and classrooms used for TV production, consult Engineering Services for guidelines.

D-E. Discuss the use of LED technology with Engineering Services where applications exist. LED shall be used for downlights and decorative luminaires. CFL shall no longer be specified on projects.

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~~E.F.~~ Medium and high bays in shops, lobbies, etc. should take into account lamp life, lamp replacement, and controllability. Investigate the use of T8 fluorescent lamps (with high ballast factor ballast) versus T5HO in these applications, and discuss options with Engineering Services. Ballasts must be rated for high temperature environment.

~~F.G.~~ Provide two (2) copies of a light fixture cutsheet booklet with any submittal showing lighting layouts. Booklet shall be in color and include the light fixture schedule as well as proposed lighting controls.

~~G.H.~~ Specify the proper disposal of mercury containing lamps per [PSU Policy SY-31](#) and PCB ballasts per [PSU Policy SY-26](#) for all renovation work.

~~H.I.~~ Include the luminaire fixture schedule within the drawings, not within the specifications. As-built drawings shall include final luminaire information.

## .02 Lamps

A. Unless otherwise approved, 48-inch linear fluorescent, lamps shall ~~either be the~~ "extra-long life", either full-wattage (32-watt) T8, 32-watt, rapid start, 2900+ initial catalog lumens, 46,000+ hour rated average life with program start ballasts based on 3-hour operating cycle or the reduced wattage (28-watt) T8. Confirm selection with Engineering Services.

B. The use of other fluorescent lamps is discouraged. ~~The use of~~ linear T5HO (high-output ) fluorescent lamps is are allowed where design applications exist, but when it is only as approved by Engineering Services.

C. Compact fluorescent lamps shall not be specified, LED luminaires or lamps shall be specified instead.

~~B.D.~~ Coordinate other lamp wattages and styles with Engineering Services, prior to specification.

~~C.E.~~ All fluorescent lamps will typically incorporate a 4100 degree Kelvin color temperature and a minimum CRI of 82.

~~D.1.~~ Qualifying extra-long life 32 watt T8, 48 inch linear lamps are as follows:

- a. GE Super Long Life: F32T8/SXL/SPX41/ECO
- b. Philips XLL: F32T8/TL841/XLL/ALTO
- c. Sylvania Octron XP/XL: FO32/841/XP/XL/ECO3

~~E.2.~~ Qualifying reduced wattage T8, 48 inch linear lamps are as follows:

- a. GE Ecolux UltraMax: F28T8/XL/SPX41/ECO
- b. Philips XLL: F32T8/ADV841/XLL/ALTO 28W

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c. Sylvania Octron XP/XL: F028/841/XP/XL/SS/ECO3

- B. Do not use incandescent lamps, unless specifically approved by Engineering Services. When allowed, provide the following:
1. "A" lamps shall be long-life, rated 125 volts, with inside frost.
  2. MR-16 lamps, up to 50 watt, shall be replaced with LED equivalent.
  3. Any wallbox dimmers or dimming system shall be set to only allow lamp operation to 90% output. This is to conserve energy as well as to extend lamp life by double.
- F. Require that the contractor obtain all similar lamp types through one source from a single manufacturer.
- G. Lamp Orientation: All lamps shall be specifically rated for the burn position in which they are used. Universal burn lamps are only acceptable in luminaires that will require aiming that will result in a lamp orientation that is neither vertical nor horizontal.
- H. Fluorescent dimming: All fluorescent lamps on dimming ballasts shall be burned in at full brightness continuously for the length of time as required by the lamp manufacturer prior to any dimming (typically 10 hours). Bypass local control as necessary to accomplish this task. Most applications only require a minimum dimming range of 5% to 10%.
- I. CFL Lamp Disposal and Cleanup: Refer to PSU Environmental Health and Safety data sheet for disposal and/or cleanup of broken CFL lamps.
- J. LED shall be used instead of CFL for all applications (downlights, decorative luminaires, etc.). Specify luminaire with a minimum lumen output (typically 1000 or 2000 lumen), minimum CRI of 80, minimum L70 of 50,000 hours, and minimum efficiency of 60-70 lumens per watt. Require testing to IES LM-79 and LM-80 standards and life calculations based on IES TM-21. CCT shall be 4100K. Chips shall be binned to no more than a 2-step MacAdam Ellipse. Consult Engineering Services as to acceptable manufacturers.
- K. LED screw-in lamps using medium base, GU24, GU10, bi-pin etc. shall be approved by Engineering Services prior to specification. PSU prefers purpose-built LED luminaires over socket based solutions.

**Sections .03 thru .07 have no revisions, add the following section:**

.08 Spare Parts

- A. Discuss with Engineering Services what spare parts to require in the specifications. Typically, require the following:
- a. 10% of each lamp type, minimum of five (5).
  - b. 10% of each ballast or driver, minimum of five (5).
  - c. 5% of each LED module type, minimum of two (2) of each. On projects with a large number of a single type, limit the number of spare parts as they will become outdated quickly.

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d. 10% of replacement lenses and globes, minimum of three (3) of each. Note specifically to which luminaire types this applies and reference the spare parts in the luminaire schedule. If decorative bowls are large, confirm with the end user whether they have space to store these materials.

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## **END of revision**

### **Update Commentary:**

Section was updated primarily for the following reasons:

- 1) Update based upon the reduction of LED luminaire pricing to consider this source for more general applications.
- 2) Clarify the type of T8 lamps to specify based upon Energy Conservation Measures instituted.
- 3) Add requirement for some spare parts, especially to deal with the increased use of LED and the fact that these sources and drivers are sometimes difficult to match only 1 year after substantial completion.