UNIFIED FACILITIES CRITERIA (UFC)

Design: Interior and Exterior Lighting and Controls

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FOREWORD

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UFC are effective upon issuance and are distributed only in electronic media from the following source:

- Whole Building Design Guide web site http://dod.wbdg.org/.

Hard copies of UFC printed from electronic media should be checked against the current electronic version prior to use to ensure that they are current.

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securing to while working on a high luminaire. If a lift will be used, a path of travel must be determined that accommodates the lift equipment.

2-11.4 Equipment Life. Select lamps, ballasts, and controls that are rated or guaranteed for long useful lives. An incandescent lamp may have a very low initial cost but may have to be replaced several times a year, while an induction lamp or LED may not be replaced for decades.

2-11.5 Considerations for improved maintenance:

- Minimize lamp types on an individual project.
- Group re-lamp luminaires within individual areas.
- Provide all luminaires with means of re-lamping and maintenance.
- Select equipment and sources with long operating lifetimes. Refer to Chapter 5, "Lighting Equipment – Lamps", for average lamp life of various sources.

CHAPTER 5

LIGHTING EQUIPMENT

5-1 BUDGET CONSIDERATIONS.

5-1.1 Selecting Equipment.

5-1.1.1 Select luminaires based on application suitability, performance, aesthetics, and initial cost.

5-1.1.2 Select lamps based on the application, energy consumption, low maintenance, life, and replacement costs. One source for determining costs is the Defense Logistics Agency (DLA). (See Appendix A for contact information.)

5-1.1.3 Select ballasts based on energy consumption, low maintenance, and life.

5-1.1.4 Select controls based on the application, low maintenance, reliability, and life.

5-1.2 Life cycle cost analysis. There are many economic factors that need to be considered when designing a lighting system. Life cycle costs include initial costs (equipment procurement and installation), energy, and maintenance costs. Additional issues involve the impact of lighting on productivity. These costs are currently not represented in the life cycle cost analysis, but have been estimated for the total Federal sector at $17.65/m^2$ ($1.64/SF per year)[1]. Since this is a significant factor, quality lighting decisions cannot be undervalued.

5-1.2.1 Initial costs: Estimate equipment quantity and unit pricing for luminaires, lamps, ballasts and controls. Also estimate the labor cost. Do not use a percentage of initial costs because this can be misleading. For example, installing direct/indirect linear fluorescent pendants may be less labor since they require only one point of electrical connection, versus individual recessed lay-in luminaires. The cost of quality lighting equipment is very economically competitive. The Defense Logistics Agency (General and Industrial Lighting) can be contacted for cost estimates of lighting equipment.

5-1.2.2 Energy costs: Energy costs should take into account not only the connected lighting loads, but also the actual loads due to daylight and manual dimming, occupancy sensors, and energy management systems. Peak power demand in most climates occurs during the sunniest days when daylight is the most available. If the peak demand can be lowered through controls, then the energy costs can be considerably lower.

5-1.2.3 Maintenance costs: Life and reliability of the lighting equipment are inherent in maintenance costs. In addition, replacement procurement and installation costs are

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[1] "Economics of Energy Effective Lighting for Offices", *Federal Energy Management Program (FEMP) Lighting Resources,* <http://www.eere.energy.gov/femp/resources/economics.html>

in mind that all of these additional advantages are only achieved when the optimized ballast is paired with the high performance lamp. These ballasts are not available as dimming, only as instant start. A premium lamp can be used on a dimming ballast, but it will not have the lamp life benefit. On a dimming, or any non-optimized, ballast, the lamp will have an average of 20,000 to 24,000 hours. See the section on ballasts for additional information. Refer to the controls section for compatible devices with various ballast types.

5-3.4.4 Requirements for linear fluorescent lamps:

- Use electronic or electronic dimming ballasts for all linear fluorescents.
- Do not mix linear fluorescent lamp color temperatures within a single building to minimize maintenance and the chance of visual confusion.
- T12 lamps are prohibited. (The Energy Policy Act of 1992 ended production of many of these lamps.)

5-3.4.5 Considerations for linear fluorescent lamps:

- Use 3500K and 75+ CRI as the default color temperature and color rendering index.
- Use 3000K in housing and hospitality applications. Use 3500K in all other applications except for maintenance facilities where 4000K may be used.
- Consider T8, T5HO, and High Performance T8 lamps based on the application, initial cost, and potential energy savings.

5-3.5 Induction Lamps. Induction lamps are essentially fluorescent lamps without electrodes. Therefore, they have very high efficiencies and extremely long lives (70,000-100,000 hours). Induction lamps have many of the fluorescent lamp advantages such as superior color rendering, instant on/off switching, and long life.

5-3.5.1 Despite the high initial cost, these lamps offer significant cost benefits regarding low energy and maintenance costs. Because a typical relamping schedule may call for changing metal halide lamps after only 15,000 hours, while induction lamps can be changed after 60,000 hours, the savings in lamp replacements and labor costs quickly pays for the higher installation cost. In some cases, the payback period may be as short as 5-7 years. Most importantly, the induction lamp is extremely reliable. When compared against higher wattage HPS lamps, the energy savings of the induction lamp reduces the payback period even more.

5-3.5.2 The ideal application for induction lamps is in areas where metal halide or high-pressure sodium lamps may be used, even though the induction lamp is larger. Long life and instant on/off induction lamp characteristics make it very reliable and easy to control with motion sensors.