UFC Exterior Spec Comparison

Requirement or Technical Spec	Unified Facilities Criteria Chapter 4 Exterior Lighting and Controls	MCB Lighting and Electrical LED Lighting Fixtures
Life Cycle Cost	"Design exterior lighting systems to minimize energy consumption, reduce maintenance costs, improve lighting quality on DoD Installations, at the lowest life cycle cost." (page 95, section 4-1)	**Total system ownership possible if desired beyond 10 years**
	"Reduce maintenance by technology selection, reducing equipment quantities, and implementing controls strategies. Select light sources, power supplies, and controls that are rated and warranted for long useful lives to increase the amount of time between maintenance cycles. Match light sources in adjacent areas when appropriate." (page 95, section 4-1.2)	**Total system ownership possible if desired beyond 10 years**
	"Refer to APPENDIX E for an example of a life cycle cost analysis (LCCA). Select lighting systems on the total ownership cost accounting for the following variables: Initial Cost, Energy Cost, Demand Cost, Utility Inflation Rate, Maintenance (Equipment) Cost, Maintenance (Labor) Cost (including cleaning of luminaire), Maintenance Inflation Rate, Replacement Cost, Disposal/Recycling Cost, Annual Hours of Operation, Lifetime (all systems must be capitalized twice in the analysis period but not to exceed 40 years.)." (page 97, section 4-1.4)	**Total system ownership possible if desired beyond 10 years**
	Note: For AF projects, For LED applications that do not have built-in failure detection in the luminaire, include labor costs to measure light levels (baseline and 70% output – before the end of the warranty) in the LCCA." (page97, section 4-1.4)	**Detection installed**
Warranty	"LED luminaires require a 10-year warranty." (page 101, section 4-4.2.1)	**Best 10 year complete wrap around warranty**
Efficiencies	"Minimize energy consumption by providing energy efficient technologies, effective luminance and illuminance levels, and implementing control strategies. Solid State Lighting (SSL)/Light Emitting Diode (LED) and induction lighting systems are established technologies for exterior lighting applications that have been proven to save energy over traditional High Intensity Discharge (HID) light sources. Therefore, SSL/LED and induction lighting must be the first consideration for all exterior lighting applications such as building, area, roadway, parking lot, pathway, sidewalk, signage, landscape, and security lighting." (page 95, section 4-1.1)	**135 LPW - 185 LPW**
Efficacy	UFC does not specify a minimum efficacy for Exterior Lighting and Controls. (pages 95 - 105)	**210 LPW coming in 2019**
Total Current Harmonic Distortion (THD)	"Total current harmonic distortion (THD) less than or equal to 20%." (page 102, section 4-4.3.1)	**"Total current harmonic distortion (THD) less than or equal to -10% at full and 50% output." (page 10, section 2-4.2.1)**
Power Factor (PF)	"Power factor (PF) greater than or equal to 0.9." (page 102, section 4-4.3.1)	**"Power factor (PF) greater than or equal to 0.9 at full and 99% output." (page 10, section 2-4.2.1)**
Dimming	"Provide in accordance with NFPA 101. Emergency lighting units must be LED for new construction. It is not life cycle cost effective to replace existing units." (page 11, section 2-7.1)	**Dimmable or bi-level drivers compatible with standard dimming control circuit of 0-10V. Other dimming protocols must comply with Network requirement.**
Lumen Depreciation	"Note: For AF projects, For LED applications that do not have built-in failure detection in the luminaire, include labor costs to measure light levels (baseline and 70% output – before the end of the warranty) in the LCCA." (page 97, section 4-1.1)	**Built in failure detection**
	UFC does not specify a minimum lumen depreciation for **Exterior Lighting And Controls with the exception for AF projects**. (pages 95 - 105)	**Complies with**

UFC Exterior Spec Comparison

Requirement or Technical Spec	Unified Facilities Criteria Chapter 2 Interior Lighting and Controls	MCB Lighting and Electrical LED Lighting Fixtures
Correlated Color Temperature (CCT)	"Use a CCT of no greater than 4100K as stated on the manufacturer's cutsheet to reduce skyglow in exterior applications. Note, per ANSI C78.377-2011 standard, nominal CCT of 4000K is 3985K +/-275K for SSL products" (page 101, section 4-4.2	**4000K**
Color Rendering Index (CRI)	"Use a color rendering index (CRI) of no less than 70 for exterior applications." (page 101, section 4-4.2)	**Greater than .85**
Photometrics (IES)	"IES LM-79, LM-80 testing reports must be supplied from manufacturer and include all relevant information." (page 8, section 2-4.1.1)	**Perform inhouse**
Light Pollution/Trespass	"Use fully shielded or IES U0 luminaires to eliminate direct light above the horizontal plane. Refer to maximum allowable uplight (U) and backlight (B) ratings in specific lighting zones." (page 95, section 4-1.3.2)	**Complies with**
Light Color	"Use monochromatic amber LEDs in place of Low Pressure Sodium (LPS) for sensitive environments such as wildlife habitat, observations, wildlife nesting, or to meet dark sky requirements (observatories). Incorporate Fish and Wildlife, State, and local governing authority recommendations for lighting systems design and installation." (page 101, section 4-4.2.1)	**Complies with**
Lighting Zones	"Lighting zones reflect the base (or ambient) light levels desired for an area. Adopt the lowest possible lighting zone. Lighting zones are best implemented as an overlay to the established zoning especially on installations where a variety of zone districts exist within a defined area or along an arterial street. Where zone districts are cohesive, it may be possible to assign lighting zones to established land use zoning. It is recommended that the lighting zone includes churches, schools, parks, and other uses embedded within residential communities or to any land assigned to a lower zone." (page 97, section 4-2)	**Complies with**
	"For DoD installations, it is important to consider all activities of an area's land use. Lighting zones must consider the surrounding areas as well. For example, adjacent lighting zones must not hinder nighttime operations. Additionally, in Outside Continental of United States (OCONUS) areas, it is important that the installation does not stand out as an exceptionally bright area compared to the adjacent development. Table 4-1 and Figure 4-1 show examples of how lighting zones may be applied to DoD installations." (page 97, section 4-2)	**Complies with**
Lighting Controls	"Lighting control requirements must meet ASHRAE 90.1, ASHRAE 189.1, and this UFC. Refer to UFC 1-200-02 for publication year of ASHRAE. Refer to CHAPTER 5 (Exterior Applications) for control requirements. Provide commissioning per ASHRAE requirements. Refer to IES DG-29 for commission guidance." (page 99, section 4-3)	**Complies with**
Network Certification	"Network control systems (including systems separate from an energy management control system) must be planned, designed, acquired, executed, and maintained in accordance with DoD Instruction 8500.01 and DoD Instruction 8510.01, and as required by individual Service Implementation Policy. Coordinate wireless networks with base spectrum manager prior to specification in case of restrictions for wireless usage within the installation." (page 100, section 4-3.2	**Complies with**
Multi-Pin Receptacle	"Streetlights must be capable of being upgraded to a wireless control system. Streetlights must be installed with an ANSI C136.41 multi-pin receptacle. This five to seven pin receptacle will accept a standard three-pin photocell until the system is upgraded." (page 100, section 4-3.2)	**Complies with**

UFC Exterior Spec Comparison

Requirement or Technical Spec	Unified Facilities Criteria Chapter 4 Exterior Lighting and Controls	MCB Lighting and Electrical LED Lighting Fixtures
Surge Protection Device (SPD)	"LED luminaires require integral metal oxide varistors (MOV) type surge protection device (SPD)." (page 101, section 4-4.2.1)	**Complies with**
	"Provide MOV type SPDs at panelboards for all circuits feeding exterior lighting systems." (page 103, 4-4.4)	**Complies with**
Over Current Protection Device	"Provide in-line fuse in pole base or splice box for street and area lights. Monitoring Equipment." (page 103, section 4-4.5)	**Complies with**
Electrical Energy Monitoring	"For new construction buildings greater than 25,000 SF (2,322 m2), terminate exterior lighting branch circuits in dedicated lighting panelboards. Provide measurement devices to separately monitor the electrical energy use for exterior lighting." (page 103, section 4-5)	**Complies with**
Redesign	"Redesign includes new luminaires, circuits, and controls designed to meet current lighting criteria. A new design must ensure reduced energy consumption, reduced maintenance, and lighting quality is improved at the lowest life cycle cost. When existing pole locations are to be used as part of the redesign, the designer must evaluate the need for pole modification to account for possible resonance issues due to wind when reducing the weight and EPA of the luminaire replacement. Lighting redesign is required when a renovation involves changing lighting technologies such as fluorescent to LED and when renovation involves changing lighting with more efficient lighting within the same technology." (page 104, section 4-7.1)	**Complies with**
One for One Luminaire Replacemen	"A luminaire replacement consists of the entire luminaire being replaced, including the housing. A luminaire replacement may be considered when the lighting design is sufficient, but more efficient luminaires are available. In instances where the existing luminaire was operating under dimming control, the control must be upgraded to be compatible with the operating characteristics of the replacement luminaire. Luminaire replacement is only acceptable when the resulting illuminance levels, glare, and distribution meet the current criteria. The designer must evaluate the need for pole modification to account for possible resonance issues due to wind when reducing the weight and EPA of the luminaire replacement." (page 104, section 4-7.2)	**Complies with**
Calculations Of Lighting For Exterior Areas	"Computer-generated photometric plans for each area are required to verify proposed luminaires and locations meet the required performance criteria of the design using \1\ the applicable light loss factor (LLF)./1/ Photometric plan submittals must include: Horizontal illuminance (or luminance for roadways) measurements at pavement, taken at a maximum of every 10 feet (3 m), Minimum and maximum illuminance (or luminance for roadways) levels, Average maintained illuminance (or luminance for roadways) level, Average to minimum and maximum to minimum ratios for horizontal illuminance (or luminance for roadways), Lighting power density (Watts per square foot or per square meter), LLF." (page 107, section 5-2)	**In-house Photomectic**

UFC Interior Spec Comparison

Requirement or Technical Spec	Unified Facilities Criteria Chapter 2 Interior Lighting and Controls	MCB Lighting and Electrical LED Lighting Fixtures
Life Cycle Cost	"Refer to APPENDIX E for an example of a life cycle cost analysis (LCCA). The LCCA must provide a comparison to LED technology for applications where LED is a viable option. Exclude maintenance costs in all retrofit life cycle cost analyses that cannot be verified." (page 4, section 2-1.4)	**Complies with**
	"Refer to APPENDIX E for an example of a life cycle cost analysis (LCCA). Select lighting systems on the total ownership cost accounting for the following variables: Initial Cost, Energy Cost, Demand Cost, Utility Inflation Rate, Maintenance (Equipment) Cost, Maintenance (Labor) Cost (including cleaning of luminaire), Maintenance Inflation Rate, Replacement Cost, Disposal/Recycling Cost, Annual Hours of Operation, Lifetime (all systems must be capitalized twice in the analysis period but not to exceed 40 years.)." (page 5, section 2-1.4)	**Complies with**
Warranty	"Consistent with industry standard, all LED luminaires require a 10-year warranty." (page 9, section 2-4.1.1)	**10-year wrap around warranty includes fixture replacement and associated labor**
Efficiencies	"Increases in Solid State Lighting (SSL)/Light Emitting Diode (LED) lighting system efficiencies are surpassing the efficiencies of linear fluorescent systems. Analyze the use of LED for interior applications." (page 5, section 2-1.5)	**135 LPW - 185 LPW**
Efficacy	UFC does not specify a minimum efficacy for interior **Luminaire Replacement and Conversion**. (pages 13 - 14)	**210 LPW coming in 2018**
	Minimum efficacy for **Luminaire Conversion Kit** is 120 lumens per watt. (page 14, section 2-8.3.1)	
	Minimum efficacy for **Light Source Retrofit** is 100 lumens per watt. (page 14, section 2-8.3.1	
Total Current Harmonic Distortion (THD)	"Total current harmonic distortion (THD) less than or equal to 20% at full and 50% output." (page 10, section 2-4.2.1)	**"Total current harmonic distortion (THD) less than or equal to -10% at full and 50% output." (page 10, section 2-4.2.1)**
Power Factor (PF)	"Power factor (PF) greater than or equal to 0.9 at full and 50% output." (page 10, section 2-4.2.1)	**"Power factor (PF) greater than or equal to 0.9 at full and 99% output." (page 10, section 2-4.2.1)**
Emergency Lighting	"Provide in accordance with NFPA 101. Emergency lighting units must be LED for new construction. It is not life cycle cost effective to replace existing units." (page 11, section 2-7.1)	**Emergency lighting available**
Dimming	"LED luminaires must be dimmable or capable of multi-level control according to the control strategy. SSL dimmers must be NEMA SSL 7A compliant to ensure that the electrical infrastructure is adequate to dim the lamps without flicker or drop outs in dimming range." (page 8, section 2-4.1.1)	**Complies with**
	"For current and future dimming requirements (i.e. smart grid, curfew, adaptive), use dimmable or bi-level drivers compatible with standard dimming control circuit of 0-10V. Other dimming protocols must comply with Network Certification requirements." (page 10, section 2-4.2.1)	**Dimmable or bi-level drivers compatible with standard dimming control circuit of 0-10V. Other dimming protocols must comply with Network requirement.**
	"Compatible with NEMA SSL 7A dimmers and dimming systems. If existing luminaires are on a dimmer or dimming system, provide a compatible dimmer or dimmer system. Dimmer or dimming systems must be NEMA SSL 7A compliant to ensure that the electrical infrastructure is adequate to dim the light source without flicker or drop outs within the dimming range." (page 13, section 2-8.3)	**Complies with**

UFC Interior Spec Comparison

Requirement or Technical Spec	Unified Facilities Criteria Chapter 2 Interior Lighting and Controls	MCB Lighting and Electrical LED Lighting Fixtures
Lumen Depreciation	"IES LM-79, LM-80, and TM-21 testing reports must be supplied from manufacturer and include all relevant information. Note: For AF projects, For LED applications that do not have built-in failure detection in the luminaire, include labor costs to measure light levels (baseline and 70% output – before the end of the warranty) in the LCCA." (page 9, section 2-4.1.1)	**Built in failure detection**
	"UFC does not specify a minimum lumen depreciation for interior **Luminaire Replacement and Conversion**. (pages 13 - 14)	**Complies with**
Correlated Color Temperature (CCT)	"Use a correlated color temperature (CCT) of no greater than 4100K as stated on the manufacturer's cutsheet for all interior spaces. Note, per ANSI C78.377-2011 standard, nominal CCT of 4000K is 3985K +/-275K for SSL (Solid State Lighting) products." (page 8, section 2-4.1)	**4000K**
Color Rendering Index (CRI)	"Use a color rendering index (CRI) of no less than 80 for interior applications." (page 8, section 2-4.1)	**Greater than .85**
Exit Signs	"Provide in accordance with NFPA 101. Internally illuminated signs must be LED type and comply with UFC 3-600-01." (page 11, section 2-7.2)	**Complies with**
Photometrics (IES)	"IES LM-79, LM-80, and TM-21 testing reports must be supplied from manufacturer and include all relevant information." (page 8, section 2-4.1.1)	**Perform inhouse**
NEMA 410	"Inrush current meets NEMA 410." (page 13, section 2-8.3)	**Complies with**
Maintenance Reduction	"Reduce maintenance by technology selection, reducing equipment quantities, and implementing controls strategies. Select light sources, power supplies, and controls that are rated and warranted for long useful lives to increase the amount of time between maintenance cycles. Minimize light source types on an individual project. Locate luminaires in locations to improve access for regular servicing such as light source replacement." (page 3, section 2-1.2)	**Wrap around warranty mitigates maintenance concerns**
Energy Reduction	"Reduce energy consumption by using energy efficient technologies, effective illuminance levels, and implementing control strategies." (page 3, section 2-1.1)	**Complies with**
Lighting Controls	"Lighting control requirements must meet ASHRAE 90.1, ASHRAE 189.1 and this UFC. Refer to UFC 1-200-02 for publication year of ASHRAE. Refer to Chapter 3 (Interior Applications) for control requirements. Provide commissioning per ASHRAE requirements. Refer to IES DG-29 for commission guidance for specific applications." (page 5, section 2-2)	**Incorporated into fixture if desired**
Daylighting Control Requirements	"Control the electric lighting in response to daylight. Continuously dim electric light in task oriented areas such as offices, conference rooms, classrooms, or turning it off in non-task areas such as circulation and lounge areas. Control primary and secondary daylight zones separately. Refer to APPENDIX C Daylighting Best Practices for additional information." (page 5, section 2-2.1)	**Incorporated into fixture if desired**
	"Refer to UFC 1-200-02 for Daylighting requirements. Coordinate architectural daylight design and lighting contribution into electrical lighting design and control. Refer to APPENDIX C in this UFC for daylighting best practices." (page 8, section 2-3)	**Complies with**

UFC Interior Spec Comparison

Requirement or Technical Spec	Unified Facilities Criteria Chapter 2 Interior Lighting and Controls	MCB Lighting and Electrical LED Lighting Fixtures
Control Strategies	"Indicate in the contract documents the control strategy for each space in accordance with narrative descriptions in Table 2-1. Refer to Chapter 3 (Interior Applications) for additional information. In normally occupied spaces, control strategies must include a means for the occupant to manually turn the lights on and off. Do not use occupancy sensors, vacancy sensors, or timers to control luminaires that provide illumination of the work space around electrical service equipment such as switchboards, panelboards, or motor control centers. To reduce energy consumption, luminaires in the adjacent space that do not provide illumination of the work space must be dimmable and controlled by an integrated or separate vacancy sensor. For this application, the luminaires can be dimmed a maximum of 50 percent of full light output and the dimming cannot be stepped.* Regardless of control strategy, the controls and illumination for the means of egress components must comply with the requirements of NFPA 101." (page 6, section 2-2.3)	**For the first 3 years system operated at 70% due to design parameters of the initial design**
Network Certification	"Network control systems (including systems separate from an energy management control system) must be planned, designed, acquired, executed, and maintained in accordance with DoD Instruction 8500.01 and DoD Instruction 8510.01, and as required by individual Service Implementation Policy. Coordinate wireless networks with base spectrum manager prior to specification in case of restrictions for wireless usage within the installation. Note: For AF projects, refer to ETL 11-1 for additional requirements." (page 7, section 2-2.4)	**Complies with**
Surge Protection Device (SPD)	"Provide metal oxide varistor (MOV) type SPDs at panel boards for all circuits feeding interior lighting systems." (page 10, section 2-4.3)	**Complies with**
Electrical Energy Monitoring	"For new construction of buildings greater than 25,000 SF (2,322 m2), terminate lighting branch circuits in dedicated lighting panelboards." (page 11, section 2-5	**Complies with**
Elevators	"Provide lighting for elevators in accordance with ASME A17.1 or ASME A17.3 as applicable." (page 11, section 2-6)	**Complies with**
Measurement & Verification (M&V)		**Experience in developing, reviewing, conducting and supporting M&V plans and all associated activities. Understanding of the measurement, montoring and performance tests to be performed based on the M&V plan. Cognizant of the Army and FEMP M&V guidelines and procedures**
Name Plates		**Each major component shall have the manufacturers name, address, equipment type or style and catalog or serial number etched on the name plate. In addition, each piece of ESPC equipment shall be identified with proper nomenclature as being provided by the ESPC ESCO.**