

SECTION 26 50 00**INTERIOR LIGHTING**

Scope - This section includes interior lighting fixtures and requirements for their selection and lighting design of spaces in which they are utilized.

Purpose – To Provide Illumination Comfort and Applicability for Occupants, Energy Efficiency, Ease of Maintenance, Cost Effective.

PART 1 - DESIGN DIRECTIVES**1.1 RELATED SECTIONS**

- A. Lighting Controls
- B. Exterior Lighting

1.2 DESIGN CRITERIA

- A. An NCQLP Certified Lighting Designer with at least 3 years of experience designing similar projects shall be consulted for projects involving new construction and renovations of over 10,000 sq. ft. Other projects and/or rooms/spaces may also warrant an NCQLP certified lighting designer such as large classrooms, auditoriums, conference and meeting rooms, public lobbies, studios, exterior landscapes, exterior façade illumination.
- B. The Architect, Lighting Designer and Engineer shall create a matrix and a narrative from the discussion at the schematic phase of the project to be included on the design development drawings that lists each room, fixture type and control strategy. This document shall become the controlling design document for all lighting and lighting control systems and will be adjusted as the design is refined to reflect changes made and incorporate additional information.
- C. Lighting and controls design schematic matrix and narrative shall include:
 - 1. Foot-candle requirements by type of space
 - 2. Control Strategies – schedule, occupancy, manual. See Sequence of Operation (SOO) models. Consultant shall develop a SOO for each room/space or type of room/space.
 - 3. Access for driver and module replacement, or lamp replacement
 - 4. Watts per square foot
 - 5. Daylighting strategies where deemed appropriate.
 - 6. Emergency egress illumination requirements (minimum levels, circuitry, control)
 - 7. Integrated controls strategies. Examples:
 - a. Will occupancy sensor status be accessed by the HVAC system controls?
 - b. Will occupancy sensor status be accessed by the window shade controls?
- D. Light Color Tuning or Warm Dimming of LED lamps or luminaires shall be applied at the request of FO&M and/or as applicable to the project.
- E. Photometric calculations for each space, type of space/area shall be provided for review in the Design Development documents.
- F. Design Drawing Requirements.
- G. Lighting layout and control drawings.

- H. Lighting Fixture Schedule shall include – luminaire description, manufacturer, model #, selected options, color, CRI, wattage, mounting surface, mounting height (pendant distance from ceiling), dimming control technology/type, voltage, driver details, finish, estimated unit cost based on Distributor Net Cost + 10%, alternates selected by the lighting designer as equal to the specified luminaire type.

1.3 DESIGN DIRECTIVES

- A. Fixtures for use on campus shall be commercially available, standard models. Custom designed/built fixtures shall not be used when standard models similar in appearance and performance are available. All custom fixtures shall be UL listed assemblies approved for use in the application to which they are specified. Fixtures shall be readily serviceable for driver and module replacement without major disassembly or removal of fixture.
- B. Illuminance Levels shall be per the following table:

Area/Room Type	Illuminance level (footcandles)
Circulation, hallways & stairs	15 +/- 5
Offices at desk and work area (task)	40 – 80 as per task
Offices, adjacent areas (ambient)	25 +/- 5
Classrooms	40 +/- 10
Laboratories (task lighting)	75 +/- 15
Detailed and intricate work (task lighting)	100 +/- 20
Tel-Data/Electrical/Mechanical rooms	50 +/- 10
Residence Rooms- ambient	10 +/- 5
Dining Areas	25 +/- 5

- C. Color temperature, Color quality shall be per the following table

Building / Area Type	Color temp	CRI minimum
Classroom, Office, Library	3500	85
Residential facility	3000	85
Athletics facility - field house, pool, gymnasium	4000	85

Dining	3000, 3500	90
Kitchen, Servery	3500, 4000	90
Gallery, Museum	Per designer	95
Laboratory	3500	90
Maintenance facilities	3500, 4000	85

- D. Unified Glare Rating of less than 20 from typical teaching or seating positions shall be provided when used in Classroom, Office, or Assembly spaces.
- E. Classroom lighting shall follow the standard for lighting and controls as follows:
 - 1. Lighting shall be dimmable.
 - 2. Control stations for all lights shall be located at presenter's location, a single button for entry scene shall be located at the entry door(s), all lights shall be controlled by vacancy sensor. Zones shall be controlled independently. See Lighting Controls section for complete SOO.
 - 3. Ceiling lights shall be zoned from front to back to allow low levels at front of classroom.
 - 4. Wallboard lights shall be provided, each location or set of locations shall be zoned.
- F. Interior Wet Location Light Fixtures: Fixtures in athletic facility shower areas and residence hall bathrooms with showers shall be wet location rated, with double powder coat finish on steel or aluminum.
- G. Stairwell Light Fixtures: Prefer wall mounted lights in stairwells. Lights shall be accessible from maximum 12-foot ladders. Fixtures shall be provided with embedded control for bi-level operation on occupancy.

1.4 EMERGENCY LIGHTING

- A. Where the facility has an emergency generator, emergency lighting shall be provided for egress lighting in corridors, lobbies, stairwells, exterior egress (to "the public way"), public restrooms, and places of assembly. Emergency lighting shall be provided in other egress areas only where they are defined by having multiple paths of egress and/or paths of egress in excess of 50 feet. Emergency lighting may be allowed for locations where safety is a concern due to the nature of the activity performed in the area.
- B. Emergency Lighting shall consist of dedicated light fixtures adequately spaced to provide the code required level of emergency egress illuminance and connected to the emergency transfer switch where an emergency generator exists.
- C. Use of Emergency lighting relays shall be limited.
- D. All lighting circuits that require generator backup and are not classified as emergency loads shall receive their power from an optional standby equipment transfer switch.
- E. In facilities where no emergency generator exists, emergency battery pack lighting shall be provided. In special circumstances, emergency lighting inverters shall be specified to provide emergency lighting. Emergency Lighting Inverters shall be provided with well-ventilated and/or air-conditioned spaces.
- F. Exit light letter color shall be determined as follows:
 - 1. Additions to existing buildings shall be the same as the existing fixtures.

2. New buildings shall be determined by the architect. DC prefers the color be red.

1.5 EXTERIOR LIGHTING

- A. See EXTERIOR LIGHTING SECTION
- B. Exterior walkway, roadway and parking lot lighting fixture concrete base foundations are specified in the Campus Landscape Constructions standards, Exterior Lighting Section.

1.6 RETROFIT VERSUS RELIGHTING

- A. Retrofit Lighting Standards Retrofit vs Relighting: Retrofitting an existing luminaire refers to upgrading lamps and ballasts to achieve reduced energy use. Luminaire locations are generally not changed, therefore luminaire performance must not be compromised by retrofitting lamps that perform substantially differently in the fixture than those for which the luminaire was designed. This is particularly a concern with use of TLED lamps in lensed fixtures and those designed for indirect lighting. Relighting of a space refers to evaluating a new lighting system including new luminaires using CAD based lighting tools to create an optimum lighting layout. With new, higher efficient LED luminaires that can be spaced farther apart than most fluorescent systems and fluorescent fixtures with TLED lamps, not only will the system have lower energy use, but the longevity of quality LED luminaires is far better than can be achieved in a retrofit. Although the cost of relighting is usually more than a simple retrofit, longer term benefits must be considered when older luminaires have exhausted their useful life. The factors beyond initial costs requiring consideration include:
 1. Lower overall wattage of new luminaires
 2. Higher lumen output of new luminaire options vs retrofit
 3. Reduction of hours of operation from integrated or system lighting controls
 4. Reduction of kWh from dimming
 5. Longevity of new fixtures vs retrofitted components, noting that retrofit options not installed according to best practice standards will not achieve average advertised life, and that advertised claims of long life may not be supported by independent testing
 6. Annual maintenance costs usually less for new fixture vs retrofit options
 7. New LED luminaire costs are often no greater than retrofit fixture options
 8. Existing luminaires should be replaced rather than retrofitted if 3 or more of the following apply.
 9. Existing Fixtures are older than 20 yrs
 - a. Luminaire efficiency for non-decorative fixtures was originally less than 80% and further degraded by age
 - b. Ballasts have not been replaced in the last 3 years
 - c. Ceilings and/or other room finishes are being upgraded
 - d. Manual or automatic dimming are required or desired
 - e. Existing technology limits the application of lighting control standards
 10. LED lamps for retrofit - Specified LED lamps shall meet current Energy Star requirements unless standards have not yet been adopted for the lamp type.
 - a. Philips is the preferred LED lamp manufacturer, except where specific features require a different manufacturer.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. APPROVED MANUFACTURERS/MODELS
 1. Exit Lights With self-diagnostics, red LEDs preferred.

2. Emergency Battery Pack Units - With self-diagnostic and remote test.
- B. LED luminaires shall meet minimum requirements of Design Lights Consortium (DLC) listing and be listed or have applied for certification unless it is a fixture category not covered by DLC or the luminaire has not yet completed the certification process and otherwise meets DLC requirements.
- C. LED fixtures for large quantity installation such as residential hall rooms, building corridors, classrooms, etc., shall be limited to a commodity type, manufactured by a well-established manufacturer, the LED source shall be warrantied to be able to be replaced after 10-15 years to meet same BIN.
- D. All specified and supplied LED products shall be evaluated according to current test standards applicable to the luminaire and/or component type including but not limited to:
 1. LM-79 LED Luminaire Photometric and Electrical testing applies to complete LED luminaires and lamps
 2. LM-80 LED Source Lumen Depreciation Testing for LED package, array, and module components
 3. TM-21 Projection of Source Lumen Depreciation based on limited testing hours
 4. TM-26 Methodologies for Projecting Failure Rate of LED Packages- to help define product reliability
 5. LM-82 LED Light Engines and Lamp Photometric and Electrical Testing at temperature- for initial performance
 6. ANSI C78.377 Chromaticity for white light LED, so that color categories align with fluorescent.
 7. UL 8750 General safety requirements for LED components and luminaires
 8. UL 1598C Light emitting Diode (LED) Retrofit Luminaire Conversion kits for troffer upgrades
 9. When available, ANSLG/ANSI C82.15 and .16 LED Drivers Test Methods and Reliability

PART 3 - EXECUTION

3.1 INSTALLATIONS

- A. Fixtures shall be secured to the steel outlet box where used. Where additional support is needed for fixtures on suspended ceilings, a steel support framework shall be used. Fixtures and appliances shall not be supported by or attached to ceiling tiles, sheet rock, or plaster.
- B. All light fixtures shall be connected to the branch circuit wiring system by means of a flexible connection. Each fixture shall be served by a single flexible connection from a junction box in the branch circuit raceway system. "Daisy Chain" connections from fixture to fixture shall only be allowed in spaces above hard ceiling and under no circumstances shall more than two cables be installed into a single fixture connection box.
- C. Refer to the Campus Landscape Construction Standards for exterior lighting installation details

3.2 TESTING, COMMISSIONING

- A. Lighting Controls shall be tested and commissioned.

3.3 RECORDS, AS-BUILT DOCUMENT REQUIREMENTS

- A. Approved Lighting Controls submittal including floor plans
- B. Approved Lighting fixture Submittal including BOM and distributor information
- C. Controls Schedule – Sequence of Operation for all spaces.

END OF SECTION 26 50 00