



Design Standard

Lighting - Interior

The lighting of a building represents one of the most important aspects of building aesthetics. The performance of these systems has a direct effect on the functionality and energy efficiency of the illuminated spaces.

Detailed specifications follow.

PART 1 - GENERAL

- 1.01 Design all lighting systems in accordance with applicable codes and standards.
- 1.02 Comply with the mandatory lighting requirements of the latest edition of ANSI/ASHRAE/IESNA Standard 90.1, *Energy Standard for Buildings Except Low-Rise Residential Buildings* for maximum allowable lighting power densities and lighting controls.
- 1.03 Illuminate all spaces in accordance with the User's requirements and within the footcandle limits specified in the latest edition of the Illuminating Engineering Society of North America (IESNA) *Lighting Handbook*.
- 1.04 Design lighting systems to limit glare, minimize uniformity ratios, and provide CRIs appropriate to the functionality of the space. Refer to the IESNA *Lighting Handbook* for guidance.
- 1.05 All interior lighting designs should provide as much of a volumetric solution as possible, minimizing the min-to-mix ratio in all spaces.
- 1.06 Do not exceed a lumen depreciation of 5.0% in the calculation of design foot candles.
- 1.07 Design lighting systems to minimize the maintenance required.
- 1.08 Provide point by point photometrics for the lighting design in each space (including corridors and stairwells). Include the light loss factor used, maximum levels, minimum levels, average levels and max. to min. ratios. Also provide point by point photometrics as described above for egress lighting. The photometrics should be provided at the DD drawing review level as well as the FRCD review level.
- 1.09 The specification of custom-designed luminaires is discouraged because of the special maintenance required.



- 1.10 See “Building Lighting Controls” in Design Standard for additional guidelines on Lighting Control Systems and Occupancy Sensors.

PART 2 - LUMINAIRES/FIXTURE TYPES

- 2.01 All luminaires shall be UL or CSA/US approved and labeled.
- 2.02 Luminaires shall incorporate a color temperature of 3500K or 4100K CCT.
- 2.03 LED is the preferred fixture type. LEDs must meet DOE “Energy Star” requirements for LED lighting.
- 2.04 Luminaires shall maintain 70% lumen output (L70) for a minimum of 50,000 hours.
- 2.05 Luminaire and driver shall be furnished from a single manufacturer to ensure compatibility.
- 2.06 Non LED Fixtures are allowable if LED fixtures do not meet special requirements and after consultation with UES.
- 2.07 Luminaire schedules shall include a minimum of three manufacturers to provide competitive pricing.
- 2.08 All LED deployed luminaires shall include field replaceable LED drivers capable of access without removal of ceiling systems or other building components to replace or service the driver.

PART 3 - FLUORESCENT LAMPS

- 3.01 Incandescent lamps are not permitted.
- 3.02 All Fluorescent Lamps shall incorporate a color temperature of 3500K or 4100K CCT, T8 rapid-start lamps, rated 28 W maximum, nominal length of 48 inches, 2800 initial lumens (minimum), CRI 85 (minimum), and average rated life of 36,000 hours.
- 3.03 Fluorescent lamps shall be suitable for use with instant start ballasts and occupancy sensors.
- 3.04 The use of T5 lamps are to be limited to architectural fixtures that are not available in T8. All proposed uses of T5 lamps are to be approved by Utilities and Energy Services (UES).
- 3.05 The use of U-tubes and biaxial lamps is not acceptable.



PART 4 - BALLASTS & DRIVERS

- 4.01** LED drivers shall be electronic-type, and comply with NEMA SSL 1 “Electronic Drivers for LED Devices, Arrays, or Systems”. LED drivers shall have a sound rating of “A”, have a minimum efficiency of 85 percent, power factor of 90%, and minimum rated life of 50,000 hours.
- 4.02** Driver and LEDs shall be furnished from a single manufacturer to ensure compatibility.
- 4.03** Ballasts for T8 and high output T5 fluorescent lamps shall be NEMA Premium Ballast (NPB) program compliant, electronic type, programmed start, and series circuited. Ballasts shall be of the single, two, three, or four-lamp type as appropriate for the switching scheme, and shall only serve one fixture.
- 4.04** Ballasts shall be marked with manufacturer’s name, part number, supply voltage, and UL Listing.
- 4.05** Dimmable ballasts/drivers with 0-10V controls are preferred. When separate control wiring is required clearly show this on the plan drawings. Route it in the same conduit as the power wiring when allowed by code and the manufacturer.
- 4.06** Fluorescent Emergency Ballasts shall consist of a high-temperature, maintenance free battery, charger and electronic circuitry contained in one metal case. A solid-state charging indicator light to monitor the charger and battery, a double-pole test switch, and installation hardware shall be provided. The emergency ballast shall be capable of operating two fluorescent lamps at 1350 lumens initial light output in the emergency mode for a minimum of 90 minutes. The emergency ballast shall have 4 Watts of input power, a 24 Watthour battery capacity, and exceed emergency standards set forth by the current NEC. The emergency ballast shall be UL Listed for installation inside, on top of, or remote from the fixture and warranted for a full five years from date of purchase.
- 4.07** Ballasts and drivers shall be rated for the extremes of ambient temperature in which they are located. Specify high ambient temperature ballasts and drivers for fixtures mounted indoors in direct sunlight or in high ambient temperature spaces.
- 4.08** Both 120V and 277V ballasts and drivers maybe used (depending on application) as both voltages are used on campus. Be mindful of which applies to your project. The preferred lighting system voltage is 277V.

PART 5 – SPACE ILLUMINATION LEVELS

- 5.01** Interior Lighting Systems shall be designed with energy conservation in mind as well as color scheme of walls, ceilings, and floors to achieve the following light levels while complying with current Energy Codes. Levels are measured in foot-



candles on a working service 30" above finished floor. The following are generally recommended light levels.

SPACE TYPE	LEVEL (FC)
Classrooms	40 - 50
Laboratories	40 - 80
Mechanical and Electrical Rooms	15 - 25
Stairwells	10 - 15
Office Areas	35 - 45
Restrooms	20 - 30
Computer Labs	25 - 35
Libraries	30 - 50
Auditoriums, Lecture Halls	30 - 40
Workshops	70 - 90
Corridors	10 - 20

PART 6 - SWITCHING

- 6.01** Provide multiple switching of interior lighting as required for flexibility and economy of operation.
- 6.02** The switching scheme in all rooms and areas shall conform to the International Building Code. Fixtures in public areas shall be controlled by occupancy sensors.

PART 7 – EMERGENCY LIGHTING

- 7.01** Each building shall be equipped with an egress lighting system which includes stairwell lights, exit lights, selected corridor lights, fire extinguisher identification



lights, and elevator cab lights. Emergency lighting shall operate twenty-four (24) hours a day. Provide emergency lighting along the path of emergency egress.

- 7.02 Emergency lighting shall include the exterior of a building and ending at a public way.
- 7.03 For new buildings, power emergency lighting from generator power when available. Verify power is coming from the Emergency system.
- 7.04 When an emergency ballast or driver is installed in a fixture, the test switch and indicator lamp shall be mounted in a location that is readily visible and accessible from an 8' ladder, without having to disassemble the fixture in any way.
- 7.05 All lighting in the building main Electrical Room housing the main switchgear/switchboard lineup shall be connected to a normal/emergency source. Luminaires in this space shall be switched with select luminaires unswitched, operating 24x7.
- 7.06 Individual battery powered lights are only permitted when an emergency power source is not available.

PART 8 – EXIT SIGNS

- 8.01 Exit lights shall be installed in accordance with the latest editions of the National Electric Code (NEC) and National Fire Protection Association (NFPA).
- 8.02 Letters and direction arrows shall be green. In all situations, the signs shall be continuously illuminated. The power shall come from the building emergency power source - EXIT light circuit/emergency generator.
- 8.03 Individual battery exit signs are only permitted when an emergency power source is not available.
- 8.04 In small renovation projects, red LED may be used to match existing signs.
- 8.05 Equipment shall be UL924 listed and labeled.

PART 9 – INSTALLATION

- 9.01 When approved, luminaires shall be installed such that they are aligned in the same relative orientation from one fixture to the next.
- 9.02 All luminaires shall be thoroughly cleaned and clear from dust, paint, construction debris and fingerprints after all other trades are complete, but prior to the date of substantial completion.



- 9.03 Ensure proper aiming and orientation of adjustable luminaires and wall washer luminaires. Coordinate with UES when applicable.

PART 10 – CLOSEOUT DOCUMENTS

- 10.01 The Luminaire Schedule will be emended on the as-built documents to reflect the actual products installed.

PART 11 – COMMISSIONING

- 11.01 The luminaires shall be properly commissioned/tested with the lighting controls to endure proper operation, zones, scenes, emergency operation, and other control settings.
- 11.02 Refer to the “Building Lighting Controls” standard for additional lighting controls commissioning requirements.

PART 12 – WARRANTY

- 12.01 Manufacturer shall provide five-year warranty against defects in materials and workmanship for all products. Project contractor shall replace defective fixtures and components during the first year of warranty without additional compensation from Texas A&M University.
- 12.02 Warranty period shall begin on date of substantial completion.