

GENERAL:

The scope of this document is to provide requirements for interior lighting.

DESIGN GUIDELINES:

1. Illumination design shall comply with the latest editions of the Illuminating Engineering Society (IES) Lighting Handbook and ASHRAE 90.1.
2. Lighting Calculation shall be submitted at Design Development. These calculations shall show iso-photo (contours) diagrams of each space, average foot candle levels and min/max ratios. These calculations shall be submitted concurrent with the ASHRAE 90.1 compliance submittal.
3. Maintenance accessibility of light fixtures shall be considered when selecting and placing fixtures.
 - 3.1. Fixtures shall not be placed over stairs. In stairwells, lights shall be located on landings.
 - 3.2. All fixtures shall be installed or mounted within 11'-0" AFF.
 - 3.3. In Auditoriums, lighting shall be designed to minimize the use of scaffolding for fixture maintenance.
 - 3.4. In no case shall fixture maintenance require the fixtures to be removed or require the demolition of the ceiling.
 - 3.5. Provide a 6'-0" electrical whip on all cove lighting so that it may be lifted out of the cove for maintenance.
 - 3.6. For Fixtures in Atriums along walkways, the fixture shall be placed a minimum of 4'-0" from the atrium opened wall and shall be positioned such that the fixture can be maintained with the ladder facing the atrium.
4. Use the same type of fixtures to the greatest extent possible throughout the facility. This reduces the storage quantities and eases the maintenance of the lighting system.
5. Use energy efficient LED fixture technology. 2x4 LED troffers and 6" LED down lights are the standard fixtures to be used on a project.
6. The minimum color rendering index (CRI) for LED fixtures shall be 80. Up to 100 for spaces that rely on true color.
7. LED fixtures shall have plug in type disconnect and be provided with a minimum 5-year warranty. Fixture manufacturer must be able to provide certified IES LM79 and TM21 data. Preference should be given to companies whose fixture is listed by Design Lights Consortium's Qualified Products List label (DLC QPL).
 - 7.1. Correlated Color Temperature (CCT) = Typically, 3500K. Consider spaces that may desire higher or lower CCT and consult with project team.
 - 7.2. Efficacy = Minimum 90 lm/watt
 - 7.3. TM21 projection = Minimum 50,000 hours at L70

- 7.4. Driver Current = 700mA or match LED module. Do not overdrive LED module.
- 7.5 Temperature rating = Minimum 25 °C (match max space conditions)
8. Lighting Control
- 8.1. Provide local switching for all lighting. Offices, corridors, equipment rooms, etc. will be provided with separate switches except for night lights.
- 8.2. Open Office spaces shall have the lighting switched in office groups. Light control shall provide for a two-hour override for lighting in these areas' afterhours.
- 8.3. One switch to provide minimal lighting is required at the back of lecture halls and auditoriums close to a door.
- 8.4. Ceiling mounted occupancy Sensors with dual contacts (Watt Stopper PIR or Dual Technology type) shall be used for lighting control in most building spaces. Wall light switches are still required in all locations where occupancy sensors are used and shall be set for manual on and automatic off. Mount sensors in locations where motion out of the room will not be seen. Typically, ceiling mounted in either corner on the doorway wall works best.
- 8.5. Any scheduled lighting control or daylight control should be done thru the building automation system.
- 8.6. Timers shall be used for lighting control in telecommunication, storage, custodial etc. rooms.
- 8.7. Manual switch in rooms for safety reasons such as mechanical and electrical rooms. Or, if automatic control is desired, the lights dim but do not power off until the occupant switches it. Note that IECC 405.3.1, Subnote 16 – Lists items that can be excluded from total connected lighting power. Although not found in ASHRAE 90.1, the University concurs with this approach.
9. All damp/wet locations (animal rooms, greenhouses, mechanical rooms, etc.) shall be provided with lighting fixtures rated for wet locations.
10. Step lighting along egress path is required in all sloped or stepped auditoriums and lecture halls.
11. All exit lights shall be LED type with integral battery and self-diagnostics.
12. Emergency/egress lighting needs to meet minimum required by code for life safety. At MU, paragraphs 12.1 – 12.3 are the preferred means of emergency power.
- 12.1. If a life safety generator is not required by code, there is a strong preference for wall or ceiling mounted LED emergency lighting units with integral battery backup and self-diagnostic features. This applies to MOST areas of any building in lieu of using select fixtures of the normal lighting system.
- 12.2. In architecturally sensitive areas (i.e. entrance experience) the use of select fixtures of the normal lighting system with a remote inverter is permitted.
- 12.3. If a life safety generator is required for a fire pump, then other life safety loads such as fire alarm and emergency egress lighting may also be served by the generator.
13. Specialty lighting for specific occupancies is acceptable if approved by the Project Manager.

14. Exterior lights should also be LED and comply with the requirements of this standard. Fixtures should match or be of similar type or style of existing fixtures in the area of campus being installed.
15. Provide lighting fixture schedules for all lighting.
16. Lay-in ceilings light fixture support. Provide one of the following:
 - 16.1. The requirements for a suspended ceiling are determined by the buildings Seismic Design Category. Determination of the Seismic Design Category is complex and must be determined by a Registered Architect or Professional Engineer and should be found in the construction documentation. Include a footnote in the lighting fixture schedule noting the requirements for bracing. Seismic bracing for light fixtures shall be as required by ASCE 7 (which adopts ASTM E580 for most of its seismic requirements for suspended ceilings.)
 - 16.2. *Whether required by code or not*, provide at minimum, two (2) #12 gage (minimum) hanger wires connected from the fixture housing (opposite corners) to the structure above.
17. Pendant light fixtures shall be supported by a minimum of two (2) #12 gage hanger wires regardless of whether seismic bracing is required by code. Add 1 hanger wire for every additional 4' of light fixture (or other approved alternate support). For instance, an 8' light fixture would require a minimum of three (3) hanger wires.