<table>
<thead>
<tr>
<th>Revision Date</th>
<th>Section</th>
<th>Summary of Change</th>
</tr>
</thead>
<tbody>
<tr>
<td>6/1/12</td>
<td>All</td>
<td>Replaced entire document with new revision</td>
</tr>
</tbody>
</table>
INTERIOR LIGHTING

UNIVERSITY CONTACT:

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Electrical Engineer, Maintenance & Operations (302) 831-4907
Facilities Planning & Construction (302) 831-1744

DESIGN REQUIREMENTS

ILLUMINATION LEVELS:

Design illumination levels for different activities and spaces shall correspond to those listed below, “LIGHTING LEVEL REQUIREMENTS.” These levels are based on the Illuminance Standards found in the 9th Edition of the IESNA Lighting Handbook. The designer shall confirm the levels given in the edition of the IESNA Lighting Handbook relevant to the project; any subsequent criteria shall supersede the levels indicated below. For activities not covered by the University standards below, refer to IES recommendations.

<table>
<thead>
<tr>
<th>LIGHTING LEVEL REQUIREMENTS</th>
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<tbody>
<tr>
<td><strong>TYPE OF AREAS</strong></td>
</tr>
<tr>
<td>(Height of Task Area)</td>
</tr>
<tr>
<td>Corridor and stairway (floor level)</td>
</tr>
<tr>
<td>Lounge, lobby and reception area (30” AFF)</td>
</tr>
<tr>
<td>Secretary/Reception area (30” AFF)</td>
</tr>
<tr>
<td>Toilet room and locker room (30” AFF)</td>
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<tr>
<td>Classroom/Lecture Hall, general seating area (30” AFF)</td>
</tr>
<tr>
<td>Classroom/Lecture Hall, front teaching area around lecturer (30” AFF)</td>
</tr>
<tr>
<td>Conference room (30” AFF)</td>
</tr>
<tr>
<td>Areas where writing, reading and typing are performed (30” AFF)</td>
</tr>
<tr>
<td>Office (30” AFF)</td>
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<tr>
<td>Laboratory (Lab Bench Countertop)</td>
</tr>
</tbody>
</table>

Note: AFF means Above Finished Floor

Designer shall refer to IESNA Lighting Handbook and relevant IESNA RP guides relevant to the project, for lighting considerations with respect to uniformity ratios and quality of light per respective space. The designer shall document the targeted footcandle levels specific to the project on a space-by-space method and issue this information to the University for review and approval no later than the design development phase of a project.

Security night lighting shall be provided for all public spaces and shall match the lighting requirements described in NFPA for emergency lighting.

LIGHTING POWER DENSITIES:

Adjusted power densities for lighting as calculated in ASHRAE 90.1 compliance procedures shall not exceed the ranges outlined below for the different building spaces, in the space-by-space method. These levels indicated below are based on the 2007 edition of ASHRAE 90.1. The designer shall confirm the levels given in the edition of ASHRAE 90.1 that is relevant to the project; any subsequent criteria shall
supersede the levels below. For spaces not indicated below refer to the edition of ASHRAE 90.1 that is relevant to the project.

<table>
<thead>
<tr>
<th>LIGHTING POWER DENSITIES</th>
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<tbody>
<tr>
<td>Library Stacks</td>
<td>1.7 W/ft²</td>
</tr>
<tr>
<td>Electrical/Mechanical Room</td>
<td>1.5 W/ft²</td>
</tr>
<tr>
<td>Conference/Meeting/Multipurpose</td>
<td>1.3 W/ft²</td>
</tr>
<tr>
<td>Classroom/Lecture/Training/Labs</td>
<td>1.4 W/ft²</td>
</tr>
<tr>
<td>Lounge/Recreation/Library Reading Area</td>
<td>1.2 W/ft²</td>
</tr>
<tr>
<td>Offices/Library Card File &amp; Cataloging/Dormitory</td>
<td>1.1 W/ft²</td>
</tr>
<tr>
<td>Dinning Area/Restrooms</td>
<td>0.9 W/ft²</td>
</tr>
<tr>
<td>Storage</td>
<td>0.8 W/ft²</td>
</tr>
<tr>
<td>Dressing/Locker/Fitting Room/Stairs</td>
<td>0.6 W/ft²</td>
</tr>
<tr>
<td>Corridor/Transition</td>
<td>0.5 W/ft²</td>
</tr>
</tbody>
</table>

LIGHTING FIXTURES:

Fixtures shall be accessible for cleaning and relamping without complete disassembly. Lenses (where used) shall be one-hundred percent (100%) virgin acrylic with a minimum lens thickness of 0.125”. Parabolic-type reflector fixtures (where used) shall have minimum three inch (3”) deep louvers.

Vertical lamp recessed compact fluorescent downlights shall be used due to better optics and ease of relamping. If the ceiling plenum space is too shallow for the vertical lamp downlights, then horizontal lamp recessed compact fluorescent downlights shall be used with University approval.

Fluorescent shall be used in classrooms, hallways, laboratories, restrooms, etc.

Use metal halide in high bay areas with an appropriate number of quartz-restrikes.

Provide Johnson hangers on High Bay Fixtures above 25’-0”.

Specular reflectors in light fixtures shall NOT be used.

Incandescent light use shall NOT be permitted unless approved by the University.

UNIVERSITY PRE-APPROVED LIGHT FIXTURE MANUFACTURERS:

- Lithonia
- Lightolier
- Cooper Lighting
- Hubbell Lighting

This is a general list of pre-approved manufacturers acceptable to the University. The use of other lighting fixture manufacturers shall be allowed, as approved by the University, on a project by project basis.

EMERGENCY SYSTEM EXIT SIGNS:

General purpose Exit Lights shall be DualLite LX-Series, unless otherwise approved by the University.

Dorm Exit Lights shall be Evenlite – vandal resistant and energy efficient

CONTROLS:

Designers shall consider and design for control schemes to limit the unnecessary operation of artificial lighting. These include:
- Combination manual switching for multiple lighting zones with occupancy sensor Auto “OFF”
- Dual technology occupancy sensors
  - With manual override for classrooms, conference rooms and offices
  - Ceiling mounted sensors are preferred
  - Wall switch mounted occupancy sensors for private offices are acceptable.
- Dimming controls (Refer to, “INTERIOR DIMMING SYSTEM”)
- Auto time schedule clock controls
- Lighting control integration through the university BAS system, where desired by the University

In accordance with ASHRAE 90.1 energy standards, provide automatic lighting controls (occupancy sensor or time scheduled) for all buildings >5,000 sf. EXCEPTION – Lighting intended for 24-hour operation.

Provide multiple zones of lighting in classrooms. At a minimum, teaching wall lights and any ceiling lights that could contribute incident light on the projection screen should be separated from the lights in the remainder of the room. During A/V presentations, the control scheme should be flexible to turn off these lights completely.

Automatic daylight controls shall be considered for all new work projects on a space-by-space basis. For spaces where natural daylighting is abundant, it is recommended that artificial lighting systems be controlled to eliminate unnecessary illumination. Controls shall be capable of dimming or turning off lights completely. Where lights are dimmed in response to natural light, a minimum of two (2) steps of reduction shall be utilized:
- Fifty percent (50%)
- One hundred percent (100%)
- Lighting circuits shall be arranged to facilitate localized control. Switch rows of fixtures along a perimeter glass wall parallel to the wall and not perpendicular.

LAMPS:

Design should take into account the standard lamp types as described herein. The designer shall limit the variety of lamp types used within a project. The use of lamp types other than what is listed below shall not be permitted, unless approved by the University.

FLUORESCENT LAMPS

A. Low-Mercury Lamps: Comply with EPA’s toxicity characteristic leaching procedure test; shall yield less than 0.2 mg of mercury per liter when tested according to NEMA LL 1.

B. T8 rapid-start low-mercury lamps, rated 32 W maximum, nominal length of 48 inches, 2800 initial lumens (minimum), CRI 80 (minimum), color temperature 3500 K, and average rated life 20,000 hours.

C. T8 rapid-start low-mercury lamps, rated 17 W maximum, nominal length of 24 inches, 1300 initial lumens (minimum), CRI 80 (minimum), color temperature 3500 K, and average rated life of 20,000 hours.

D. T5 rapid-start low-mercury lamps, rated 28 W maximum, nominal length of 45.2 inches, 2900 initial lumens (minimum), CRI 85 (minimum), color temperature 3500 K, and average rated life of 20,000 hours. T5 lamps shall be used for renovation projects only when the entire building is being renovated, and also for new construction of buildings. There shall not be a mix of T5 and T8 lamps in a building.

E. T5 rapid-start low-mercury lamps, rated 14 W maximum, nominal length of 22.2 inches, 1350 initial lumens (minimum), CRI 85 (minimum), color temperature 3500 K, and average rated life of 20,000 hours.
F. T5HO rapid-start, high-output low-mercury lamps, rated 54 W maximum, nominal length of 45.2 inches, 5000 initial lumens (minimum), CRI 85 (minimum), color temperature 3500 K, and average rated life of 20,000 hours. T5HO lamps shall be used for renovation projects only when the entire building is being renovated, and also for new construction of buildings. There shall not be a mix of T5HO and T8 lamps in a building.

G. Compact Fluorescent Lamps: 4-Pin, low mercury, CRI 80 (minimum), color temperature 3500 K, average rated life of 10,000 hours at 3 hours operation per start, and suitable for use with dimming ballasts.

1. 13 W: T4, double or triple tube, rated 900 initial lumens (minimum).
2. 18 W: T4, double or triple tube, rated 1200 initial lumens (minimum).
3. 26 W: T4, double or triple tube, rated 1800 initial lumens (minimum).
4. 32 W: T4, triple tube, rated 2400 initial lumens (minimum).
5. 42 W: T4, triple tube, rated 3200 initial lumens (minimum).
6. 55 W: T4, triple tube, rated 4300 initial lumens (minimum).

H. High Lumen Compact Fluorescent Lamps: 4-Pin, low mercury, 82 CRI (minimum), color temperature 3500 K, and suitable for use with dimming ballasts.

1. 40 W: T5, long double tube, rated 3150 initial lumens (minimum), average rated life of 20,000 hours at 3 hours operation per start.
2. 55 W: T5, long double tube, rated 4800 initial lumens (minimum), average rated life of 12,000 hours at 3 hours operation per start.

HID LAMPS

A. Metal-Halide Lamps: ANSI C78.1372, with a minimum CRI 65, and color temperature 4000 K.

B. Pulse-Start, Metal-Halide Lamps: Minimum CRI 65, and color temperature 4000 K.

C. Ceramic, Pulse-Start, Metal-Halide Lamps: Minimum CRI 80, and color temperature 4000 K.

UNIVERSITY APPROVED LAMP MANUFACTURERS:

- Philips
- Osram-Sylvania
- GE