Lighting-Interior 26.51.00

Description:

The purpose of the section is to highlight the current applicable UMD Design Standards for the design, selection and, installation of lighting fixtures within buildings.

Related Sections:

- 26 56 00 Lighting – Extension

Effective Date:

January 1, 2020

Applicable Standards:

- ASHRAE 90.1-2007
- Illuminating Engineering Society of North America (IESNA) Standards

General Requirements:

The application of this section applies to all interior and exterior lighting in "new building" designs. This section also applies to "renovation work" within existing buildings--if the installation of new light fixtures, or the relocation of existing light fixtures is a part of the renovation, and the lighting work involves at least 50% of the lighting within the renovated space. Any deviation or exception to the requirements of this section requires the prior written approval of the Director of the Operations and Maintenance (O&M) Department in Facilities Management Electrical Systems Section, as well as notification to the Electrical Systems Section within O&M.

Light Fixture Components Not Allowed

- Lamps
  - Fluorescent T-12 lamps
  - Linear fluorescent "U-Tubes"
  - Linear fluorescent lamps in any length other than nominal 24" or 48"
  - Incandescent lamps
  - Mercury vapor lamps
  - High or low pressure sodium lamps
  - Interior horizontal mounted lamps (except linear fluorescent) in any fixture mounted higher than 10' above the floor level
- Ballasts
  - Magnetic
  - Ballasts containing PCB's, DEHP, oil or hazardous substances
  - Any ballast not rated for multiple voltages (120/277 volt)

Recommended Light Fixture Components/Requirements

- Occupancy Sensors
  - In hallways
  - In main mechanical or electrical rooms.

- Lamp Color
  - Color temperature shall be 5000K or higher
  - Color Rendition Index (CRI) of 80 or higher

- Lamp Life
  - Lamps (non-fluorescent) shall have an "average" lamp life of 5000 hours or more
  - Lamps installed in fixtures over 12' high, shall have a lamp life of 10,000 hours or more

- Lamps installed within “BSL Labs”, “Clean Rooms” or hazardous areas, shall have a lamp life of 10,000 hours or more.
- Ballasts
  - Hallways utilizing linear fluorescent fixtures shall utilize “Step-Dimming” ballasts, which have two “hot” leads, and provide lighting levels of 0%, 50%, and 100%.
  - Be rated for multiple voltage operation, at 120 volts or 277 volts.
  - Ballasts utilized in linear fluorescent fixtures with a Ballast Factor within one of the following ranges, shall be designed to meet “light level” and “power density” requirements utilizing a ballast at the lowest level within the range given. For instance, if a designer selects a fixture with a Ballast Factor of 1.2 for a particular space, then the designer shall ensure the light level and power density requirements are still met if the ballast is replaced with a 1.0 Ballast Factor ballast.
  - High--1.15 to 1.30
  - Normal—0.95 to 1.14
  - Low-- 0.70 to 0.94

Light Fixture Recommendations/Guidelines

- Hallways
  - Overhead fixtures
  - Cooper 2’ x 2’ fixture, 2AC-214T5-UNV-L5850-TUB228PU95S50D-UM
  - Lithonia 2RT5 14T5 MVOLT GEB10PS LP850
  - H.E. Williams HETG-S22-214T5S-A-EBSD2-UNV or approved equal fixture, with “step-dimming” (0%, 50% & 100%) ballast
  - Ballast disconnect plugs. Hallway light fixtures shall have a three wire disconnect plug.

- Special Rooms
  - Fixtures installed in “Clean Rooms“, “BSL Labs” or hazardous areas shall have the ballasts and light switches mounted remotely--outside of the clean area.

- Exit Signs
  - Shall be 2 watts or less LED fixtures. Exit fixtures with special features, such as “vandal resistant” fixtures, shall be 5 watts or less.
  - Shall be red exit signs, unless in an existing building, where new exit signs should match the color in the remainder of the building.

- ~~Outdoor~~
  - ~~Outside street, walkway and parking lot lighting fixtures shall be the “Gardco” shoebox fixture utilizing metal halide lamps in 175 watt, 400 watt, and 1000 watt sizes.~~
  - ~~Fixtures shall be mounted on square tapered poles.~~

Lighting Installation/Performance Guidelines

- **Energy Consumption**
  - The power consumption level of lighting fixtures shall be determined on a “Space-by-Space” method.
  - The power consumed by lighting fixtures within a “space type”, shall not exceed a value determined by multiplying 65% times the value listed in ASHRAE 90.1-2007 “Lighting Power Densities (LPD) Using the Space-by-Space Method”.
  - All light fixtures within a space type shall be included in this calculation, including wall washer, decorative, bulletin board, cove, task, special lighting and overhead light fixtures.
  - The “input Power” rating of the light fixture shall be used in this calculation.
  - For “screw-in” type lamps, the wattage used for the above calculation shall be the highest “UL rated” lamp wattage allowed in the fixture.

- **Lighting Levels**
  - General
    - Light levels shall be as specified by the Illuminating Engineering Society of North America (IESNA) handbook (latest edition), unless modified below.
    - Light levels shall be measured by "full spectrum" light meters, or at a level of 90% of IESNA Standards using "photopic" light meters.
  - Classrooms, Offices and Labs
    - Light levels in classrooms shall be as indicated in IESNA on at least 90% of the desks in the classrooms.
    - Light levels in offices shall be as indicated in IESNA, with the recommended level measured on the portion of the desk used for detailed reading or paper work. The IESNA recommendation is not an average for the entire room, but is the level on the work surface.
    - "Average Light Level" range: 30 – 50 foot-candles, calculated on the desk and table tops.
  - Hallways
    - "Average Light Level" range: 5 to 8 foot-candles, calculated at floor level.
    - "Max to Min" Ratio Maximum: 5
  - Restrooms
    - Shall be designed for 5 to 8 foot-candles.
  - Stairwells
    - Shall be designed for 10 fc on the walking surfaces.
  - Electrical and Mechanical Rooms
    - Electrical switchgear, distribution panels, motor control centers and branch panels shall have 50 fc measured at a height of 5'-0" above the finished floor along the front of the equipment and the rear of the equipment (if there is maintenance access).
    - Provide an average level of 30 fc throughout the remainder of the room (measured at 5'-0" level).

- **Power Source**
  - The hallway, lobby, stairwell, exit and emergency egress lighting fixtures required for emergency egress shall be powered from a 277 volt "emergency power" source originating from either an emergency generator or a central battery system such as a "Central Inverter System" (UPS System).
  - Hallway and lobby lighting that is over and above that needed for "emergency egress lighting" shall be connected to the "switched" leg of the emergency power source (see detailed description of hallway wiring below), or connected to a "non-emergency" power source utilizing occupancy sensors.
  - The "Central Inverter System", if utilized, shall have an automatic "self-test" and "record" function, a bypass switch, the ability to communicate status via phone dialer, or similar feature. The inverter shall also include local status alarms.
  - In main Electrical and Mechanical rooms, 50% of the light fixtures throughout the room shall be on an emergency power source.
  - All overhead lighting within the building shall operate at 277 volts, if available within the building.

- **Controls**
  - In main mechanical and electrical rooms, "timer switches" with the ability to warn occupants by flashing the lights as "off-time" gets close, may be used on no more than 50% of the lighting in the room.
  - The outdoor lighting for sidewalks, parking lots and street shall be controlled via central photocell to turn the lights on, and a 7 day/24 hour time clock to turn the lights off, and a "Hand-Off-Auto" (HOA) switch to operate the lights manually. The HOA switch shall be mounted in an area not accessible to the general public.
  - Hallway, stairwell, lobby, exit, or emergency egress lighting needed to support emergency egress requirements, shall not be connected to local wall switches.
  - Locate light switch at the main entrance to the room.

- **Wiring Configuration**
  - Hallway Wiring
    - An “Emergency Power” conduit system shall be installed to support the hallway lighting.
    - The conduit system shall consist of an EMT conduit (appropriately sized), from the main electrical room, to the top floor of the building.
    - The conduit shall rise from the lowest floor to the top floor near the center of the building.

  - Typical Wiring
    - At each floor of the building, above the suspended ceiling or in an accessible location, a junction box shall be installed in the conduit run. The junction box shall be at least 8” x 8” x 4”.
    - Inside the conduit system, a series of #10 AWG wires (minimum size) shall be installed from the main electrical room to the junction box on each floor as indicated below;
    - Two circuits (7 wires) shall be installed to each floor of the building for connection to exit, hallway, stairwell, emergency egress and lobby lighting. A three story building, would have 6 circuits (19 wires) in the Emergency Power conduit system as the conduit leaves the main electrical room.
    - The first circuit to each floor shall leave the Emergency Power Panel (generator or inverter source) and enter a “relay” or “lighting controller” box (minimum size 20” x 16” x 6”). The “hot” shall be spliced within the “relay” box, to two wires—one a “switched” wire and the other an “un-switched” wire. The “switched” wire shall be Orange. The “un-switched” wire shall be Brown. The neutral wire shall be Gray and the ground wire shall be green, and shall accompany the two “hot” wires.
    - The second circuit to each floor shall leave the Emergency Power Panel (generator or inverter source) and enter the “relay” box. The “hot” shall be spliced to two wires—one a “switched” wire and the other an “un-switched” wire. The “switched” wire shall be Yellow. The “un-switched” wire shall be Brown. The neutral wire shall be Gray and the ground wire shall be green, and shall accompany the two “hot” wires.
    - The two “hot” wires, neutral and ground wire shall continue to the junction box, be capped with wire nuts, and identified (via tags) with the “Power Panel #” and “Circuit Breaker #” where the two “hot” wires originated.
    - The “Emergency Power” conduit system from the main electric room to every floor of the building shall be installed along with the first project that installs or relocates any hallway lighting.
    - From the junction box on each floor, install two 12/3 MC cables down one direction in the hallway, and two other 12/3 MC cables down the other hallway direction. Runs greater than 750’ need to have the MC cable size re-evaluated. Down each hallway, the outer casing of one of the MC cables shall be “striped” to indicate the “Orange” interior wire, and the other MC cable may be “striped” to indicate the “Yellow” interior wire, or may have a plain exterior jacket, but it must be different than the other (striped) MC jacket.
    - Exterior “striped” MC cable shall AFC Cable Systems, Kaf-Tech or approved equal
    - Connect the two phase wires in one 12/3 MC cable which goes down one direction in the hallway, to the two “hot” wires in one of the two circuits for that floor (from the main electric room). Splice in another two phase wires from the 12/3 MC cable going down the hallway in the other direction. This provides for a single circuit from the main electric room, feeding two 12/3 MC cables leaving the junction box, going down the hall in two different directions.
    - Repeat the step above for the other two 12/3 MC cables leaving the junction box. This provides a second circuit from the main electric room, feeding two 12/3 MC cables leaving the junction box, going down the hall in two different directions.
    - The two steps above provide two different circuits to be going down each direction of the hallway. This allows a 12/3 MC cable to be connected to “every other” light fixture in the hallway--so that every other fixture is fed by a different circuit. This would permit one breaker or circuit to trip, and still have every other fixture still operating in the hallway.

- For each light fixture in the hallway, connect a 12/3 MC cable. Connect the two phase wires in the MC cable to the two "hot" wires on the light fixture "step-dimming" ballast. One of the wires will be a "switched" leg, and the other will be an "un-switched" leg.
- For lighting within a room, the "home run" circuits shall be terminated in a ceiling (or above ceiling) mounted junction box, before going to the light switch.
- Light switches in new buildings shall have EMT conduit installed from the switch to a junction box above the ceiling. This allows future wiring changes for various switch opportunities.
- Support MC Cables from building structure as required by the NEC.

- **Fixture Mounting**
  - Fixtures mounted in stairwells shall be mounted at no more than 12'-0" above the flat landing surface in the stairwell, or utilize an integral "fixture lift" system.
  - Fixtures mounted over 15'-0" above the finished floor level shall utilize one of the following;
  - Be accessible from a standard stepladder (12'-0" max ladder height)
  - Utilize an integral "fixture lift" system
  - Be accessible from a "man lift" system, owned and stored in the building
  - Utilize remote accessible ballasts
  - Have an FM approved maintenance plan
  - Locate fixtures at telecommunications closets to the front and rear of data racks. Coordinate locations with UM OIT.
  - Recessed/Above Ceiling Lighting Components
    - Lighting system components that are mounted above a suspended ceiling, such as power supplies, controls, relays, etc., shall be located within 6'-0" of the main entrance door to the space, but to the side, out of the path of travel.
  - Supports
    - Lighting fixtures shall be supported in accordance with code.
    - Sprinkler piping or hangers shall not be used to support non-sprinkler system components, per NFPA 13.
  - Labels
    - Junction boxes utilized for power distribution, shall be labeled on the cover plate with the following information.
    - Circuit Number (feeding the light fixture)
    - Power Panel Number
    - Room Number for Panel location