

WVU DESIGN GUIDELINES & CONSTRUCTION STANDARDS

DIVISION 26 – ELECTRICAL

SECTION 265100 – INTERIOR LIGHTING

PART 1 - GENERAL

1.1. Any deviation from the following instructions must be approved during design by WVU Facilities Management Personnel.

1.2. DEFINITIONS

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| A. | AHJ | Authority Having Jurisdiction |
| B. | BAS | Building Automation System |
| C. | CCT | Correlated Color Temperature |
| D. | CFR | Code of Federal Regulations |
| E. | CSA | Canadian Standards Association (International) |
| F. | CRI | Color Rendering Index |
| G. | FC | Foot Candles |
| H. | FCC | Federal Communications Commission |
| I. | FM | Facilities Management |
| J. | IES | Illuminating Engineering Society |
| K. | LED | Light-Emitting Diode |
| L. | PE | Project Engineer |
| M. | PM | Project Manager |
| N. | UL | Underwriters Laboratories |

1.3. Consideration shall be given to quality, longevity, and ease of maintenance when specifying lighting and control systems.

1.4. Lighting and control design shall comply with all applicable codes.

1.5. Unless noted otherwise, the current edition of the IES Lighting Handbook shall be used as a standard for required lighting levels at WVU.

1.6. Disposal Guidelines

- A. For renovation projects, specify the proper disposal of fluorescent lamps and ballasts per the requirements listed in Section 5.3 'Universal Waste' of the WVU Waste Management Standard Operating Procedure document.

1.7. Lighting and Control Guidelines for Specific Applications

- A. Elevators: In general, lighting shall be designed to meet or exceed illumination requirements of current applicable elevator codes.

1. Pit Lighting

- a. Provide a minimum maintained lighting level of 10 FC at all locations along pit floor including those shadowed by equipment. Light level shall be achieved using low profile fully enclosed and gasketed (IP65 rated) industrial LED luminaires. Luminaires shall

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have an impact-resistant lens and hubs on each end of housing for power feed connections. Mount light fixture horizontally in pit. Provide toggle switch within reach of pit ladder and mounted higher than 24" above finished pit floor. Provide switch guards.

2. Hoist way Lighting
 - a. Unless noted otherwise, provide (1) low profile fully enclosed and gasketed (IP65 rated) industrial LED luminaire at each landing above the pit at a maximum distance of 10 feet on center. Luminaires shall have an impact-resistant lens and hubs on each end of housing for power feed connections. Mount luminaires vertically preferably near a corner. Provide 3-way switches in pit and top of shaft along with 4-way switches at each elevator access (landing) point for control of hoist way lighting. Hoist way lighting shall be controlled separately from lighting located in pit and top of shaft. Mount switches at 48" above landing level and within reach of access point for switches located in hoist way. Provide switch guards.
 3. Landings
 - a. Illuminate the landing sill (on the elevator lobby side) to a minimum maintained light level of 10FC. Luminaires providing this lighting level shall be uncontrolled and connected to the local life safety panel (if applicable).
 4. Machine Rooms/Closets and Control Rooms/Closets
 - a. Provide minimum maintained light level of 19 FC at all locations along the floor including those shadowed by equipment. Light level shall be achieved using low profile fully enclosed and gasketed (IP65 rated) industrial LED luminaires. Luminaires shall have an impact-resistant lens and hubs on each end of housing for potential power feed connections. Provide toggle switch guard for control.
 5. 'Machine Room-Less' Elevators
 - a. Provide 19 FC shall be provided in the location where the machine will be serviced (usually within the hoist way)
- B. Classrooms:
1. For ceiling heights up to 10 feet, provide high-quality recessed LED luminaires that provide a uniform light distribution (omni-directional, wide distribution or volumetric LEDs). Fixtures shall include 0-10V dimmable driver capable of dimming to 10%.
 2. For ceiling heights above 10 feet and large lecture halls, consider utilizing pendant-mounted direct/indirect LED luminaires with 0-10V dimmable drivers capable of dimming to 10%. Direct and indirect lighting components shall be dimmed separately for ultimate flexibility in lighting levels and distribution. Confirm luminaires will not interfere with sight-lines of ceiling-mounted projection equipment.
 3. Provide dimmer(s) for manual-on control along with occupancy sensors for automatic-off control. Sensors shall be set to vacancy mode and have a time-out delay of 15 minutes.
 4. In a classroom with windows and/or skylights, consider utilizing a daylighting control strategy to potentially reduce electric lighting load.
 5. Provide a minimum of two lighting zones in any classroom utilizing projection equipment.

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6. Washer lights shall be provided for all wall mounted writing surfaces. This includes whiteboards and chalkboards.
 - a. For smart boards, please coordinate and required number and location with WVU Facilities Management.
 7. Aisle Lighting shall be provided in all tiered classrooms.
- C. Stairwells:
1. Utilize luminaires with integral occupancy sensors and dimming drivers capable of fully adjustable high-low dim operation and time-out delay. Luminaires shall remain on at a reduced light output (10%) when stairwell is declared unoccupied. Luminaire shall fade over 10 seconds from high light level to low light level to low light level in lieu of an instantaneous transition. Minimum code-required egress illumination shall be maintained at all times.
- D. Main Electrical Rooms and Generator Rooms:
1. Lighting shall be connected to the building's stand-by power system. A select number of luminaires shall remain uncontrolled and illuminate the space 24 hours per day. The rest of the lighting shall be switched. Provide battery-powered emergency lighting units in generator rooms located on the interior of a building as a redundant source of emergency lighting in the event of a stand-by power system failure.
- E. Offices and Other Administrative Areas:
1. Utilize high-quality recessed LED luminaires that provide a uniform light distribution (omni-directional, wide distribution or volumetric LEDs) controlled via manual-on wall device (switch or dimmer) and automatic-off occupancy sensor set to vacancy mode. Time-out delay shall be set to 15 minutes.
- F. Gang Restrooms:
1. Control lighting via occupancy sensor with time-out delay set to 30 minutes. Provide normal/emergency lighting within the space that shall operate uncontrolled 24-hours per day.
- G. Corridors:
1. Control lighting via occupancy sensors set to dim lighting to 50% after 30 minutes and dim to 10% after 60 minutes if no motion is sensed in a space.
 2. Provide minimum required egress illumination that shall operate uncontrolled 24 hours per day.
- H. General Public Areas:
1. Provide automatic lighting controls (occupancy sensors or time-clock scheduled systems) for all public areas in buildings larger than 5,000 sq. ft.
 2. Occupancy sensors shall be set to dim lighting to 50% after 30 minutes and dim to 10% after 60 minutes if no motion sensed in the space.
 3. Provide minimum required egress illumination that shall operate uncontrolled 24 hours per day.

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4. Timeclock scheduling shall be reviewed and confirmed with WVU Facilities Management during design phase.
 5. If time-clock scheduled system deployed, provide minimum of one manual station capable of overriding timeclock function for a maximum of two hours. Confirm required number and location of override stations with WVU Facilities Management
- I. Exterior Building-Mounted Lighting:
1. Unless otherwise noted, provide centralized photocell control, timeclock control, or central lighting system control for all exterior building-mounted lighting in lieu of each luminaire having an integral photocell.
- J. Emergency Egress Lighting:
1. Each building shall be equipped with an emergency egress lighting system as required by applicable codes. Provide emergency egress illumination along the path of egress, including at exterior side of egress doors. Exterior emergency egress illumination shall safely light a path of travel for occupants to the public way or to an approved distance from the building per the AHJ.
 2. Unless otherwise noted, all emergency egress lighting shall operate 24-hours per day and be connected to the emergency life safety system. In areas where control (switching or dimming) of the emergency egress lighting is required, a UL924-approved emergency device (Bodine GTD20A, Wattstopper ELCU, or equal) shall be deployed.
 3. Unless otherwise noted, battery powered emergency lighting units shall not be used in buildings with generator designated for back-up of life safety systems.
 4. Battery powered emergency lighting shall be provided in all interior building spaces which house life-safety/stand-by power sources and transfer equipment.
 5. Provide emergency lighting at fire alarm control panel and extender panel locations.
- 1.8. Occupancy Sensors
- A. Coordinate occupancy sensor layout with furniture layout and HVAC diffuser layout. Do not locate occupancy sensors within 2 feet of HVAC diffusers.
 - B. Provide single occupancy sensor for control of lighting and HVAC in a space. Specify occupancy sensors with auxiliary relay for connection to HVAC system in stand-alone rooms.
 - C. Provide dual technology occupancy sensors in partitioned spaces (bathrooms, open office areas, etc.)
 - D. In the construction documents, require the successful controls vendor to submit final system layout drawings for review and approval as part of the shop drawing package. Alternate system vendors shall be required to modify their system layout as necessary to be considered equal to the specified vendor's system design at no additional charge to the Owner.
- 1.9. BAS Integration
- A. Designer shall work with WVU Facilities Management Controls Group to confirm project requirements for interface with building BAS.
 - B. Networked lighting control systems shall be BACnet compatible for integration with BAS system (if applicable)
 - C. Manufacturers

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1. Siemens is campus-preferred BAS manufacturer.

1.10. Commissioning and Owner-Training

- A. Required that the lighting control elements be properly set and tested for optimal operation. These elements include: occupancy sensors, BAS interface, dimming controls, daylight harvesting controls, UL924-approved emergency devices, networked and non-networked lighting control systems (including all control system function, scheduled events, and networking operational parameters). Commissioning will not be considered complete until all required communication between systems is proven successful. WVU Facilities Management shall be invited to attend commissioning sessions. Require seven days of notice be provided to WVU Facilities Management prior to the start of a commissioning session.
- B. Designer shall confirm the need for owner training on the specified control system with WVU Facilities Management during design. If training requested, provide description of the extent on the construction documents.
- C. Consult WVU Facilities Management for direction on timeclock scheduling, control device engraving, and adjustable fixture aiming.
- D. Designer shall confirm the need for post occupancy (3-month, 6-month and/or 12-month) visit(s) by Manufacturer's Representative to tweak and potentially reprogram larger control systems with WVU Facilities Management during design.

1.11. Cleaning

- A. Require all luminaires to be thoroughly cleaned and clear from dust, paint, construction debris, and fingerprints after all trades have completed their work but prior to the date of substantial completion.

PART 2 - PRODUCTS

- 2.1. Battery packs will not be used in buildings with generators unless required by code or as noted above.

2.2. Manufacturer Preference:

- A. Provide the names of at least three manufacturers for each light fixture type unless otherwise approved by WVU Facilities Management
- B. Confirm if there are any other manufacturer preferences with WVU Facilities Management prior to specification.
- C. Approved manufacturers
 1. Lighting control systems
 - a. Wattstopper
 - b. Lutron

2.3. Lighting;

- A. All luminaires shall be UL or CSA/US approved and labeled.
- B. Provide LED light fixtures for all interior and exterior building-mounted lighting applications. The use of LEDs will save energy, reduce maintenance costs, and eliminate mercury-containing lamp use. In certain circumstances (ex. Small renovation project) the use of other light sources may be

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considered. Review special circumstances with WVU Facilities Management prior to specification of any light source other than LED.

- C. LED luminaires shall have the following characteristics:
1. Minimum CRI of 80
 2. Minimum L70 of 50,000 hours
 3. Minimum efficiency of 70 lumens per watt
 4. Tested to IES LM-79 and LM-80 standards. These standards shall be based on life calculation IES TM-21.
 5. CCT shall be 4000K. In certain circumstances, the use of a lower CCT may be considered upon review by WVU Facilities Management prior to specification.
 6. LEDs shall be binned to no more than a 2-step MacAdam Ellipse.
- D. LED luminaires are preferred over socket-based LED lamp solutions. In certain circumstances, LED lamps using screw-in medium base, GU24 base, GU10 base, bi-pin base, etc. may be considered upon review by WVU Facilities Management prior to specification.
- E. LED drivers shall have the following characteristics:
1. Maximum driver current of 350mA
 2. Dimmable to at least 10%
 3. Operating temperature range of -40 degree C to 50 degree C. High bay fixture driver shall be rated for high temperature environments.
 4. UL Class I or II output
 5. Minimum Power Factor of 90%
 6. Total Harmonic Distortion of 20% Maximum
 7. Comply with FCC 47 CFR part 15 on consumer RFI/EMI standards
- F. Standard luminaire lenses shall have a thickness of 0.125". Consider using a greater thickness of lens for fixtures in high abuse areas.
- G. Exit signs shall have the following characteristics:
1. Exit signs shall be LED, vandal-resistant, and have red letters.
 2. Ceiling-mounted exit signs are preferred (where applicable) over wall-mounted signs for ease of service, replacement, and relocation in the future.
 3. Self-contained exit signs powered by a radioactive source are not acceptable.
- H. Washer Lights
1. Omega Lighting OM241H39BXWW 24" Recessed Biax Wall Wash or Lightolier – Wal-Lyter (WLRN124120SB), Wal- Master (WMRL124120SB).
 2. Color: White
 3. ETHDF 140TT5 ballasts, universal ballasts.
 4. 40 Watt Biax lamps, T8 lamps
- I. Aisle Lighting
1. Tivoli SoftStep II
 2. Color: Amber

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2.4. Lighting Controls

- A. Switches- heavy duty, specification grade, quiet operating, toggle or decora style, 20A, 120/277V. Engraving required where three or more control devices ganged together.
- B. Wall box dimmers- Offers adjustable high- and low-end trim levels. No rotary-style dimmers permitted.
- C. Discuss the use of networked lighting control systems for new construction and major renovation projects with WVU FM prior to specification.
- D. Classrooms
 - 1. Interface RS232-1 for remote control at lectern
 - 2. If room is 277V - DA10HDFI 277 or DA20HDFI 277, 1 per scene. If room is 120V – MSP600VA - 1 per scene.
 - 3. MSPRW-1 per entrance door.
 - 4. MSP5AVES (Ellipse Series) – 1 per.

PART 3 - EXECUTION

3.1. Light fixture location and height shall consider ease of replacement and maintenance.

3.2. A reflected ceiling plan is required on all projects.

3.3. 95% Design Review Submission with WVU

- A. Provide Review Submittal Drawings showing lighting and controls layouts. Include a PDF booklet of lighting fixture and control system cut sheet for review. Booklet shall be in color and include a copy of the luminaire schedule.
- B. Unless previously approved by WVU, Luminaire Schedule shall be issued as part of the drawing set and not in the specifications.
- C. WVU requires the Design Professional to submit drawings (PDF format) showing Point-by-Point Lighting Calculations for all Interior and Exterior (Building-Mounted) Lighting Projects. Calculations for 'typical rooms' shall be acceptable except when there is a drastic difference in the room dimensions and furniture layouts. Point values shall be legible and shown on a scaled drawing. Show calculations for each space without daylight contribution. Highlight where the design is non-IES target illumination level compliant. WVU FM will provide direction and variance where deemed appropriate. Utilize AGI-32 or similar program to complete these calculations.
- D. Provide a spreadsheet showing all Room Names/Numbers, Target Maintained Illumination Levels (Example- Average Illuminance, Max-to-Min Ratio, Average-to-Min Ratios) and Calculation Results for comparison with the target levels.
 - 1. For specialty area such as Performing Arts Spaces, Sports Venues, TV Studios, etc., consult WVU FM for guidelines and preferences.

3.4. Construction Submittals

- A. WVU FM shall review all product submittals but it is the sole responsibility of the Design Professional to approve or reject the submittal. Do not mark any them "Approved as Noted – Pending WVU

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Review" or similar. Discuss any questions or concerns with WVU FM prior to returning the document to the Contractor. WVU's review shall be simultaneous to that of the Design Professional.

3.5. As-Built Documents

- A. Require Contractor to amend the luminaire schedule on the As-Built Documents to reflect the actual lighting products installed.
- B. Require Contractor to indicate final locations of all lighting control system devices on the As-Built Documents. Label devices to reflect actual products installed.

3.6. O&M Manuals

- A. Require the following luminaire information:
 - 1. Warranty information for LED fixtures along with LED Modules and Drivers (if separate warranty applies).
 - 2. Contact information for each product's manufacturer, manufacturer's local representative, and distributor where product was purchased.
 - 3. Copy of approved construction submittals.

END OF SECTION 265100