INTERIOR LIGHTING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:

1. Interior lighting fixtures with lamps and ballasts.

2. Lighting fixtures mounted on exterior building surfaces.

3. Exit signs.

B. Related Sections include the following:

1. Division 26 Section "Wiring Devices" for manual wall-box dimmers for incandescent lamps.

2. Division 26 Section "Lighting Control Devices" for automatic control of lighting, including time switches, photoelectric relays, occupancy sensors, and multipole lighting relays and contactors.

3. Division 26 Section "Dimming Controls" for architectural dimming systems.

1.3 DEFINITIONS

A. BF: Ballast factor. Ratio of light output of a given lamp(s) operated by the subject ballast to the light output of the same lamp(s) when operated on an ANSI reference circuit.

B. CRI: Color rendering index.

C. CU: Coefficient of utilization.

D. LER: Luminaire efficiency rating, which is calculated according to NEMA LE 5. This value can be estimated from photometric data using the following formula:

1. LER is equal to the product of total rated lamp lumens times BF times luminaire efficiency, divided by input watts.

E. RCR: Room cavity ratio.

1.4 SUBMITTALS

A. Product Data: For each type of lighting fixture scheduled, arranged in order of fixture designation. Submit as one package, bound together. Include data on features, accessories, finishes, and the following:

1. Physical description of fixture, including dimensions and verification of indicated parameters.

2. Fluorescent and high-intensity-discharge ballasts.

3. Air and Thermal Performance Data: For air-handling fixtures. Furnish data required in "Submittals" Article in Division 23 Section "Diffusers, Registers, and Grilles."

4. Sound Performance Data: For air-handling fixtures. Indicate sound power level and sound transmission class in test reports certified according to standards specified in Division 23 Section "Diffusers, Registers and Grilles."

5. Lamps.

6. Photometric performance data.

B. Shop Drawings: Show details of nonstandard or custom fixtures. Indicate dimensions, weights, methods of field assembly, components, features, and accessories.

C. Wiring Diagrams: Power, signal, and control wiring.

D. Coordination Drawings: Reflected ceiling plan(s) and other details, drawn to scale, on which the following items are shown and coordinated with each other, based on input from installers of the items involved:

1. Suspended ceiling components.

2. Structural members to which lighting-fixture suspension systems will be attached.

3. Other items in finished ceiling, including the following:

a. Air outlets and inlets.

b. Speakers.
c. Sprinklers.
d. Access panels.

E. Product Certificates: For each type of ballast for dimmer-controlled fixtures, signed by product manufacturer.

F. Source quality-control test reports.

G. Field quality-control test reports.

H. Operation and Maintenance Data: For lighting equipment and fixtures to include in emergency, operation, and maintenance manuals. In addition to items specified in Division 1 Section "Closeout Procedures," include the following:

1. Catalog data for each fixture. Include the diffuser, ballast, and lamps installed in that fixture.

I. Warranties: Special warranties specified in this Section.

1.5 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

B. Comply with:

1. NFPA 70 - National Electrical Code.

2. NECA/IESNA 500-1998 – Recommended Practice for Installing Indoor Commercial Lighting Systems.

3. NECA/IESNA 502-1999 – Recommended Practice for Installing Industrial Lighting Systems.

4. Resource Conservation and Recovery Act (RCRA), May 1994.

5. Comprehensive Environmental Response, Compensation and Liability Act (CERCLA).

6. Code of Federal Regulations (47 CFR 37342).

7. Michigan Department of State Police, Fire Marshall Division Policy Number 11-06 “Plastic Materials as Interior Finishes” pertaining to the use of plastic lenses in lighting fixtures for health care facilities.

C. FMG Compliance: Fixtures for hazardous locations shall be listed and labeled for indicated class and division of hazard by FMG.

D. NFPA 101 Compliance: Comply with visibility and luminance requirements for exit signs.

1.6 COORDINATION

A. Coordinate layout and installation of lighting fixtures and suspension system with other construction that penetrates ceilings or is supported by them, including HVAC equipment, fire-suppression system, and partition assemblies.

1.7 WARRANTY

A. Special Warranty for Emergency Lighting Unit Batteries: Manufacturer's standard form in which manufacturer of battery-powered emergency lighting unit agrees to repair or replace components of rechargeable batteries that fail in materials or workmanship within specified warranty period.

1. Warranty Period: 10 years from date of Substantial Completion. Full warranty shall apply for first year, and prorated warranty for the remaining nine years.

B. Special Warranty for Fluorescent Ballasts: Manufacturer's standard form in which ballast manufacturer agrees to repair or replace ballasts that fail in materials or workmanship within specified warranty period.

1. Warranty Period for Electronic Ballasts: Five years from date of Substantial Completion.

C. Manufacturer's Special Warranty for T8 Fluorescent Lamps: Manufacturer's standard form, made out to Owner and signed by lamp manufacturer agreeing to replace lamps that fail in materials or workmanship, f.o.b. the nearest shipping point to Project site, within specified warranty period indicated below.

1. Warranty Period: One year from date of Substantial Completion.

1.8 EXTRA MATERIALS

A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Lamps: 10 for every 100 of each type and rating installed. Furnish at least one of each type.

2. Plastic Diffusers and Lenses: 1 for every 100 of each type and rating installed. Furnish at least one of each type.

3. Battery and Charger: One for each emergency lighting unit.

4. Ballasts: 1 for every 100 of each type and rating installed. Furnish at least one of each type.

PART 2 - PRODUCTS

2.1 FIXTURES AND COMPONENTS, GENERAL

A. Recessed Fixtures: Comply with NEMA LE 4 for ceiling compatibility for recessed fixtures.

B. Incandescent Fixtures: Comply with UL 1598. Where LER is specified, test according to NEMA LE 5A.

C. Fluorescent Fixtures: Comply with UL 1598. Where LER is specified, test according to NEMA LE 5 and NEMA LE 5A as applicable.

D. HID Fixtures: Comply with UL 1572. Where LER is specified, test according to NEMA LE 5B.

E. Metal Parts: Free of burrs and sharp corners and edges.

F. Sheet Metal Components: Steel, unless otherwise indicated. Form and support to prevent warping and sagging.

G. Doors, Frames, and Other Internal Access: Smooth operating, free of light leakage under operating conditions, and designed to permit relamping without use of tools. Designed to prevent doors, frames, lenses, diffusers, and other components from falling accidentally during relamping and when secured in operating position.

H. Reflecting surfaces shall have minimum reflectance as follows, unless otherwise indicated:

1. White Surfaces: 85 percent.

2. Specular Surfaces: 83 percent.

3. Diffusing Specular Surfaces: 75 percent.

4. Laminated Silver Metallized Film: 90 percent.

I. Plastic Diffusers, Covers, and Globes:

1. Acrylic Lighting Diffusers: 100 percent virgin acrylic plastic. High resistance to yellowing and other changes due to aging, exposure to heat, and UV radiation.

a. Lens Thickness: At least 0.125 inch minimum unless different thickness is scheduled.
b. UV stabilized.

2. Glass: Annealed crystal glass, unless otherwise indicated.

J. General:

1. Install ballasts, and specified accessories at factory.

2. Install lamps on project site after fixture installation.

3. Provide factory installed ballast disconnecting means required by NFPA 70.

2.2 LIGHTING FIXTURES

A. Provide lighting fixtures as included in specification 26 5100A “Lighting Fixture Product Data.” This section contains product data sheets from the basis of design manufacturer with annotations.

B. Acceptable alternate manufacturers are indicated on the product data sheets. Alternate manufacturer products shall be equal in all respects including materials, finishes, photometric performance and energy performance and shall include all options, features, and accessories identified.

C. The lighting fixture schedule shown on the drawings is supplemental provided for convenience and reference only. The requirements of this section and 26 5100A shall govern.

2.3 FLUORESCENT LAMP BALLASTS

A. Description: Include the following features, unless otherwise indicated:

1. Designed for type and quantity of lamps indicated at full light output.

2. Externally fused with slow-blow type rated between 2.65 and 3.0 times the line current.

B. Program rapid start electronic ballasts for linear lamps shall include the following features, unless otherwise indicated:

1. Products:

   a. Advance/Phillips.
   b. Sylvania/Motorola.
   c. ACE (for low temperature ballast).

2. Comply with NEMA C82.11.

3. Ballast Type: Programmed rapid start, unless otherwise indicated.

4. Programmed Start: Ballasts with two-step lamp starting to extend life of frequently started lamps.

5. Sound Rating: A.

6. Total harmonic distortion rating of less than 10 percent according to NEMA C82.11. Input current third harmonic content shall not exceed 10%.

7. Transient Voltage Protection: IEEE C62.41, Category A.

8. Operating Frequency: 25 kHz or higher, and operate without visible flicker.

9. Lamp Current Crest Factor: Less than 1.7.

10. Parallel Lamp Circuits: Multiple lamp ballasts connected to maintain full light output on surviving lamps if one or more lamps fail.

11. Power factor shall be 90% minimum.

12. Ballast factor shall be .875 to 1.00.

C. Ballasts for compact lamps shall have the following features, unless otherwise indicated:

1. Products:

   a. Advance/Phillips.
   b. Sylvania/Motorola.

2. Type: Electronic.

3. Power Factor: 90 percent, minimum.

4. Flicker: Less than 5 percent.

5. Lamp Current Crest Factor: Less than 1.7.

6. Electronic Ballast Operating Frequency: 25 kHz or higher.

7. Lamp end-of-life detection and shutdown circuit.

8. Transient Protection: Comply with IEEE C62.41 for Category A1 locations.

9. THD shall be 20% or less. Input current third harmonic content shall not exceed 20%.

10. Ballast shall be UL listed, Class P with a sound rating at or below Class A.

11. Interference: Comply with 47 CFR, Chapter 1, Part 18, Subpart C, for limitations on electromagnetic and radio-frequency interference for nonconsumer equipment.

D. Ballasts for dimmer-controlled fixtures shall comply with general and fixture-related requirements above for electronic ballasts and the following features:

1. Products:

a. Advance/Phillips.
b. Lutron.

2. Dimming Range: 100 to 5 percent of rated lamp lumens.

3. Ballast Input Watts: Can be reduced to 20 percent of normal.

4. Compatibility: Certified by manufacturer for use with specific dimming system indicated.

5. Provide ballast suitable for specified lamp type.

E. Ballasts for Low-Temperature Environments:

1. Temperatures Minus 20 deg F and Higher: Electromagnetic type designed for use with high-output lamps.

2.4 HIGH-INTENSITY-DISCHARGE LAMP BALLASTS

A. General: Comply with NEMA C82.4 and UL 1029. Shall include the following features, unless otherwise indicated.

1. Type: Constant-wattage autotransformer or regulating high-power-factor type.

2. Minimum Starting Temperature: Minus 22 deg F (Minus 30 deg C) for single-lamp ballasts.

3. Normal Ambient Operating Temperature: 104 deg F (40 deg C).

4. Open-circuit operation that will not reduce average life.

5. Provide ballast suitable for lamp specified.

B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Advance/Phillips.

2. Universal Lighting Technologies.

3. Valmont Electric.

C. Auxiliary, Instant-On, Quartz System: Automatically switches quartz lamp on when fixture is initially energized and when momentary power outages occur. Automatically turns quartz lamp off when high-intensity-discharge lamp reaches approximately 60 percent light output.

D. Low-Noise Ballasts: Manufacturers' standard epoxy-encapsulated models designed to minimize audible fixture noise. Sound rating – ‘B’ or better.

E. Metal Halide Electro-Reg Ballast

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Hubbell.
b. Howard Industries.

2. Description: ANSI C82.4, metal halide lamp ballast.

3. Provide ballast suitable for lamps specified.

4. Sound Rating: ‘B’ or better.

2.5 EXIT SIGNS

A. General: Comply with UL 924; for sign colors and lettering size, comply with authorities having jurisdiction.

B. Internally Lighted Signs:

1. Lamps: Light-emitting diodes, 70,000 hours minimum of rated lamp life.

C. Self-Powered Exit Signs (Battery Type): Integral automatic charger in a self-contained power pack.

1. Battery: Sealed, maintenance-free, nickel-cadmium type with special warranty.

2. Charger: Fully automatic, solid-state type with sealed transfer relay.

3. Operation: Relay automatically energizes lamp from battery when circuit voltage drops to 80 percent of nominal voltage or below. When normal voltage is restored, relay disconnects lamps from battery, and battery is automatically recharged and floated on charger.

D. Provide edge lit signs with a mirror plaque background.

2.6 FLUORESCENT EMERGENCY LIGHTING FIXTURES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Internal Type:

a. Philips Emergency Lighting: Philips Bodine.
b. Iota.
c. Dual Lite.
d. Lithonia.

2. Description: Self-contained, modular, battery-inverter unit factory mounted within fixture body. Comply with UL 924.

3. Emergency Connection: Operate one or two fluorescent lamps continuously. Connect unswitched circuit to battery-inverter unit and switched circuit to fixture ballast.

   a. For any area where only one luminare is provided for emergency operation, two lamps shall operate under loss of normal power.

4. Night Light Connection: Operate one or two fluorescent lamps continuously.

   a. For any area where a night light also operates as an emergency light and only one luminare is provided for night light/emergency operation, two lamps shall operate under loss of normal power.

5. Test Switch and Light-Emitting-Diode Indicator Light: Visible and accessible without opening fixture or entering ceiling space. Install remote test switch and plate in adjacent ceiling tile.

6. Battery: Sealed, maintenance-free, nickel-cadmium type with minimum seven-year nominal life.

7. Charger: Fully automatic, solid-state, constant-current type.

8. Lamp Ratings:

Lamp Type	Minimum Lumen Output (one or two lamps)
F25T8	1250/1100
F32T8	1350*
F28T5	1245*
F54T5HO	1200
PLT70W	1200
PLT57W	1150
PL-T 42W	1000
PL-T 32W	700/1000
PL-T 26W	575/875
PL-T 18W	375/625
F13TBX/PL-C 13W	350/425
PL-C 26W	450/700
PL-C 18W	375/500
F50 BX	900*
F40 BX	900*
F39/36 BX	1100*
F27/24 BX	1100*
F18 BX	500*

   * Indicates ratings for minimum output for one and two lamps.

9. Universal transformer to operate at 120 volt or 277 volt.

2.7 FLUORESCENT LAMPS

A. Low-Mercury Lamps: Comply with Federal toxic characteristic leaching procedure test, and 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 1219 mm, 2800 initial lumens (minimum), CRI greater than 80, color temperature of 3500 K, and average rated life of 20,000 hours, unless otherwise indicated.

C. Compact Fluorescent Lamps: CRI greater than 80, color temperature 3500, average rated life of 10,000 hours at 3 hours operation per start, unless otherwise indicated.

1. T4, Twin Tube: Rated 5 W, 250 initial lumens (minimum).

2. T4, Twin Tube: Rated 7 W, 400 initial lumens (minimum).

3. T4, Twin Tube: Rated 9 W, 600 initial lumens (minimum).

4. T4, Twin Tube: Rated 13 W, 825 initial lumens (minimum).

5. T4, Twin Tube: Rated 18 W, 1250 initial lumens (minimum).

6. T4, Twin Tube: Rated 24 W, 1800 initial lumens (minimum).

7. T4, Twin Tube: Rated 36 W, 2900 initial lumens (minimum).

8. T4, Twin Tube: Rated 50 W, 4300 initial lumens (minimum).

9. T4, Double-Twin Tube: Rated 13 W, 900 initial lumens (minimum).

10. T4, Double-Twin Tube: Rated 18 W, 1200 initial lumens (minimum).

11. T4, Double-Twin Tube: Rated 26 W, 1800 initial lumens (minimum).

12. T4, Triple Tube: Rated 18 W, 1200 initial lumens (minimum).

13. T4, Triple Tube: Rated 26 W, 1800 initial lumens (minimum).

14. T4, Triple Tube: Rated 32 W, 2400 initial lumens (minimum).

15. T4, Triple Tube: Rated 42 W, 3200 initial lumens (minimum).

D. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

E. Fluorescent Lamp Manufacturers:

1. Osram Sylvania.

2. General Electric.

3. Philips.

2.8 HIGH-INTENSITY-DISCHARGE LAMPS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

B. High Intensity Discharge (HID) Lamp Manufacturers:

1. Osram Sylvania.

2. General Electric.

3. Philips.

4. Venture.

C. High-Pressure-Sodium Lamps: NEMA C78.42, wattage and burning position as scheduled, CRI 21 (minimum), color temperature 1900, and average rated life of 24,000 hours.

2.9 FIXTURE SUPPORT COMPONENTS

A. Comply with Division 26 Section "Electrical Supports" for channel- and angle-iron supports and nonmetallic channel and angle supports.

B. Single-Stem Hangers: 1/2-inch steel tubing with swivel ball fittings and ceiling canopy. Finish same as fixture.

C. Twin-Stem Hangers: Two, 1/2-inch steel tubes with single canopy designed to mount a single fixture. Finish same as fixture.

D. Wires: ASTM A 641/A 641M, Class 3, soft temper, zinc-coated, 12 gage.

E. Wires For Humid Spaces: ASTM A 580/A 580M, Composition 302 or 304, annealed stainless steel, 12 gage.

F. Rod Hangers: 3/16-inch- minimum diameter, cadmium-plated, threaded steel rod.

G. Hook Hangers: Integrated assembly matched to fixture and line voltage and equipped with threaded attachment, cord, and locking-type plug.

H. Aircraft Cable Support: Use cable, anchorages, and intermediate supports recommended by fixture manufacturer.

2.10 FINISHES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

B. Fixtures: Manufacturers' standard, unless otherwise indicated.

1. Paint Finish: Applied over corrosion-resistant treatment or primer, free of defects.

2. Metallic Finish: Corrosion resistant.

2.11 SOURCE QUALITY CONTROL

A. Provide services of a qualified, independent testing and inspecting agency to factory test fixtures with ballasts and lamps; certify results for electrical ratings and photometric data.

B. Factory test fixtures with ballasts and lamps; certify results for electrical ratings and photometric data.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install in accordance with manufacturers instructions and N.E.C.A./I.E.S.N.A. 500-2006 and 502-2006.

B. Locate recessed ceiling luminaires as indicated on reflected ceiling plan.

C. Fixtures: Set level, plumb, and square with ceilings and walls. Install lamps in each fixture.

D. Support for Fixtures in or on Grid-Type Suspended Ceilings: Use grid for support.

1. Install a minimum of four ceiling support system rods or wires for each fixture. Locate not more than 6 inches from fixture corners.

2. Support Clips: Fasten to fixtures and to ceiling grid members at or near each fixture corner with clips that are UL listed for the application.

3. Fixtures of Sizes Less Than Ceiling Grid: Install as indicated on reflected ceiling plans or center in acoustical panel, and support fixtures independently with at least two 3/4-inch metal channels spanning and secured to ceiling tees.

E. Support luminaires independent of ceiling framing. Support recessed grid luminaries from two opposite corners directly to structure. Wire or rod shall have breaking strength of the weight of fixture at a safety factor of 3.

F. Install recessed luminaires to permit removal from below.

G. Install recessed luminaires using accessories and firestopping materials to meet regulatory requirements for fire rating.

H. Suspended Fixture Support: As follows:

1. Install suspended luminaires and exit signs using pendants supported from swivel hangers except where noted to use chain hangers. Provide pendant length required to suspend luminaire at indicated height.

2. Pendants and Rods: Where longer than 48 inches, brace to limit swinging.

3. Stem-Mounted, Single-Unit Fixtures: Suspend with twin-stem hangers.

4. Continuous Rows: Use tubing or stem for wiring at one point and tubing or rod for suspension for each unit length of fixture chassis, including one at each end.

5. Continuous Rows: Suspend from cable.

I. Adjust aimable fixtures to provide required light intensities.

J. Install surface mounted luminaires and exit signs plumb and adjust to align with building lines and with each other. Secure to prohibit movement.

K. Emergency lighting units and fluorescent emergency lighting fixtures with unit battery inverters shall be circuited to unswitched hot leg of adjacent circuit and shall activate on loss of primary power.

3.2 CONNECTIONS

A. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

B. Make wiring connections to branch circuit using building wire with insulation suitable for temperature conditions within luminaire.

C. Bond products and metal accessories to branch circuit equipment grounding conductor.

D. Connect luminaires to branch circuit outlet boxes provided under Division 26 Section "Raceways and Boxes" using 1/2" flexible conduit.

3.3 FIELD QUALITY CONTROL

A. Inspect each installed fixture for damage. Replace damaged fixtures and components.

B. Examine each luminaire to determine suitability for lamps specified.

C. Verify normal operation of each fixture after installation.

D. Test for Emergency Lighting: Interrupt power supply to demonstrate proper operation. Verify normal transfer to battery power source and retransfer to normal.

E. Prepare a written report of tests, inspections, observations, and verifications indicating and interpreting results. If adjustments are made to lighting system, retest to demonstrate compliance with standards.

F. Corroded Fixtures: During warranty period, replace fixtures that show any signs of corrosion.

G. Check for variance in lamp color temperature throughout project.

H. Spot check for lamp output level from start up through 10 minute duration and make rotation.

I. All fluorescent and H.I.D. lamps shall be allowed to run a minimum of 100 hours, continuously, prior to punchlist or any dimming.

3.4 ADJUSTING

A. Aim and adjust luminaires as directed by the Architect/Engineer.

B. Adjust exit sign directional arrows as indicated on Drawings.

C. Relamp luminaires that have failed lamps at Substantial Completion.

D. Adjust all “low end trim” settings of dimming switches prior to punchlist.

E. Adjust and calibrate all dimming system controls until the system works as designed. Contact the Architect/Engineer when dimming is complete and demonstrate operation to owner’s representative and Architect/Engineer.

3.5 CLEANING

A. Clean electrical parts to remove conductive and deleterious materials.

B. Remove dirt and debris from enclosures and lenses.

C. Clean photometric control surfaces as recommended by manufacturer.

D. Clean finishes and touch up damage.

LIGHTING
MARCH 17, 2008

1. Light Levels – General: All new lighting installations at the University shall comply with the latest version of ANSI/ASHRAE/IESNA Standard 90.1 1-2004 except that the lighting power budgets for building area method shall be 21% more efficient than stated. Lighting requirements for the most common University building areas are set forth in this standard. The referenced light levels are understood to be a maintained light level. Light levels are measured at a 30-inch height from the floor or at the actual work surface and represent the average level for the area or workstation. Circulation areas beyond workstations should be lighted to one-third the light level of the workstation, but in no case less than 20-foot candles.
    a. Specify that contractors shall fuse all indoor and outdoor lighting fixtures when installed.
2. Special lighting applications such as recreational field lighting shall comply with the latest Illuminating Engineering Society (IES) standard or as directed by the University Architect.
3. Student Study Areas and Classrooms: Provide 40 to 60 footcandle light level at workstation. Workstations equipped with video display terminals (VDT's) or computers should be illuminated with 30 to 50 footcandles as recommended by the latest edition of the National Institute for Occupational Safety and Health (NIOSH) standards.
    a. Switching in classrooms shall provide for switching the fixtures in the front and seating area separately to facilitate the use of overhead projectors, etc.
    b. Light fixtures at workstations with video display terminals or computers should be located perpendicular to device in order to minimize glare and viewing difficulty.
4. Staff and Faculty Office Workstations: Provide 40 to 50 footcandle light level at workstation.
5. Workstation Where Critical or Fine Work is Performed, as in Laboratories or Drafting Rooms: Provide 50 to 70 footcandle light level.
6. Corridors, Stairwells, Lobbies, Waiting Rooms, Storage and Service Areas: Provide 10 to 20 footcandle light level.
7. Rest Rooms, Lockers and Showers: Provide 20 to 30 footcandle light level.
8. Lecture Hall and Auditorium Lighting: Provide 40 to 60 footcandle light level at all seating locations. For a lecture hall stage area, provide 40 to 60 footcandle light level. For an auditorium stage area, the lighting shall comply with the latest IES standard or as directed by the University Architect. Provide separate switching for stage and seating area.
9. Parking Ramp Interior: Provide 1 to 3 footcandle light level in the traffic lanes, 1 to 3 footcandles in the parking areas, and 1 to 3 footcandle light level at the entrance/exit. All values are average maintained horizontal footcandles. Uniformity shall be 10:1 for the entire area. HPS shall not be used in parking structure.
10. Outside Security, Building Perimeter, Parking Lot and Outside Walkways: Provide 1 to 3 footcandle light level.
11. Outdoor lighting levels shall be designed as follows:
    a. Primary walkways and problem areas: 1 footcandles average and .5 footcandles minimum.
    b. Secondary walkways and other areas: .5 footcandle and .10 footcandle minimum.
    c. Primary streets: 2 footcandles average and .25 footcandle minimum.
    d. Parking lots: 1 footcandle average and .25 footcandle minimum.
    e. High activity outdoor parking (i.e. St. John Arena): 2.4 footcandles average and .6 footcandle minimum.
12. Temporary Site Lighting During Construction: Sufficient lighting shall be provided such that Campus Police may observe the entire area. Provide a light level of 1 to 3 footcandles. The Contractor is responsible for providing temporary lighting outside of the project area if the project interrupts the normal lighting to the area.
13. Mechanical Rooms: Provide 50 to 60 footcandle light level. Mechanical room fixtures shall be "turret style" industrial fluorescent fixtures with wire guards. Sockets shall be protected by housing and shall not be exposed. Provide emergency egress lighting.

INTERIOR LIGHTING
MARCH 17, 2008

1. Recommended Fixtures: Fluorescent fixtures using 4 foot T5 tubes are generally preferred. Incandescent lighting may be used only with the written permission of the University Architect. Any department requesting approval of incandescent lighting must be willing to accept financial responsibility for the maintenance of the incandescent lighting. Where incandescent lamps are used as part of an equipment system or alarm, provide six (6) spare lamps of each wattage.
    a. High pressure sodium (HPS) lamps shall not be used indoors. For warehouse large areas and high ceilings T-5 high output reflective fluorescent lighting fixtures shall be used.
    b. Mercury vapor lights are not to be used for indoor use. Exceptions, for research applications, must be submitted by the Associate for review by Technical Services.
    c. Metal halide lamps shall only be used in areas where there is assurance that they will be turned off at least once a week; this reduces the possibility of an explosion at end of life. Their use should be limited to areas in which network television coverage is expected, accurate color rendering is required, or gymnasiums.
    d. Fluorescent Fixtures: All fixtures shall be independently supported from the structure above. Fixtures shall be all metal with hinged shielding louvers. Recessed fixtures with hinged frame open louvers may be used where required for architectural effect. 277-volt fixtures shall be used where this voltage is available. Fixtures shall meet or exceed the requirements of the latest version of ANSI/ASHRAE/IESNA Standard 90.1 2004.
    e. Quartz lamp fixtures are not recommended; if used they must have lenses to protect against exploding lamps.
    f. Ballasts: High frequency electronic type, specifically designed to use T5 lamps, instant start, to operate multiple lamps in a parallel configuration. Ballasts shall meet minimum performance standards as established by the Certified Ballast Manufacturers Association. Additional requirements shall include a maximum total harmonic distortion of 20 percent, sound rating of “A”, shall comply with applicable standards as set by ETL, FCC, NEC, IEEE, be listed by UL and carry a 5-year replacement warranty. Separate ballasts should be provided for each lighting fixture; exception, tandem or cross ballasting of adjacent fixtures is permitted provided the fixtures are directly connected to each other. For applications where one ballast is used to light multiple fixtures, the location of other fixture shall be identified.
        i. Ballasts for compact fluorescent lamps shall be electronic type and shall have the following characteristics:
            1. Ballasts to be high power factor type.
            2. Ballasts factor shall be .95 or greater.
            3. Ballasts for multiple lamps shall be parallel wiring type.
            4. Minimum starting temperature shall be 50 degrees F.
            5. Fixtures with multiple ballasts shall have individual fusing for each ballast.
            6. Ballast shall contain end of lamp life fault mode shutdown protection.
2. Line Fuses: A line fuse shall be included in the fixture for each ballast in addition to the internal protection of the class “P” ballasts. Line fuses shall be appropriate for the application and wired in place by the fixture’s manufacturer. Fusing for fluorescent lighting fixtures shall be non-time delay type similar to Bussman type GLR with HLR holders.
3. Lenses shall not be specified as an alternative for louvers. If lenses are required for the job, the job shall be engineered for these units. Tempered lenses shall be specified on quartz lamp fixtures.
4. Fluorescent Lamps: 4-foot, 32-watt and 2-foot, 17 watt, T5, instant start lamps with color temperature of 3500K and minimum CRI of 85.
5. Specify the use of exit signs utilizing Light Emitting Diodes (LED) light source with life expectancy greater than ten (10) years.
6. Incandescent Lamps: When approved by the University, specify the 130-volt, inside frosted lamp for general application.
7. Lighting Safety: Stairwells in buildings shall have sufficient fixtures so that the loss of one lamp or ballast will not leave the area dark. The mounting of the fixtures shall not be at the extreme height but must be accessible for maintenance. Position fixtures only on side walls over landings at a maximum height of 8-feet. Fixtures shall have lenses; no bare lamps shall be permitted.

8. Provide the following spare parts with the listed quantities for compact and T5 fluorescent fixtures for each item and size required:
    a. Fuses: 10%, minimum of 15 per amp rating.
    b. Fuse Holders: 10%, minimum of 5 per type.
    c. Ballasts: 5%, minimum of 3 of each type.
    d. Lamp Sockets: 10%, minimum of 10 of each type.
    e. Fixture Lenses and Supporting Hardware: 10%, minimum of 2 of each type.
9. All submittal reviews for compact T5 fluorescent fixtures shall include the following:
    a. Catalog cut sheets.
    b. Lists of spare parts with quantities to be furnished.
    c. Samples of fixtures along with a sample of each spare part to be supplied.
        i. Turn spare parts over to the University area shop supervisor and obtain signed receipt.
        ii. A copy of each approved submittal and a copy of each signed receipt shall be included in the Operation and Maintenance Manuals.
10. Spare lamps should be provided as follows:

Lamp Type	Quantity Installed	No. of Spares
HID	1-10	1
	11-20	6
	21 or more	12
Fluorescent	1-10	1
	11-20	6
	21-50	12
	51-200	16
	201 or more	72

Quantity of lamps installed and not fixtures should be calculated for each lamp type and wattage.

11. Incandescent lighting is permitted in dedicated telephone equipment rooms.

EXTERIOR LIGHTING
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14. Lighting for the entire site, including driveways, walks, parking areas and the building perimeter shall be included in the contract documents.
15. Fixtures: High intensity discharge (high pressure sodium lamps) fixtures mounted on the building or on suitable standards are required for all exterior site lighting. These fixtures shall be automatically controlled by photocell(s) and/or the automated building management system.
    a. Light control shall be provided on all exterior lighting fixtures. The fixture shall be insect proof. Vandal proof fixtures shall be used if the fixtures are mounted 10 feet or less off the ground.
16. Fixture Location: Fixtures shall be located in such a manner that dark voids and excessive glare in windows are eliminated. Accessibility for servicing must be considered in locating fixtures. Consideration must also be given to light spillage onto adjacent facilities (existing or planned) such as greenhouses, which are light sensitive. Use directional or shielded lighting as necessary. Check with the University Engineer for the type of lights. Grounding rods shall be installed in all lighting poles.
    a. .
17. Design outdoor lighting to be fed from 100 amp switch, which in turn feeds 100 amp contactor with coil controlled by a photocell. Run all 3-phase legs and neutrals to lighting standards and fuse each pole individually. Alternate each pole to different phase legs and balance phases. Use twist lock type photo controls to control contactors.

18. The University has no secure storage. Any existing poles, luminaires, concrete collars or screw-in bases removed for relocation at a later date must be stored off campus at the project's expense or in the staging area. Luminaires must be removed prior to pole removal and stored indoors. Any items, except for luminaires, being turned over to the University may go to the University designated storage location. Luminaires shall be taken to the M/E Shop at 2560 Kenny Road.

END OF SECTION