

26 50 00 Lighting

1. General

1.1. Lighting designs shall reference the latest revisions of the following documents:

- a) Ontario Building Code
- b) IESNA Lighting Handbook
- c) Queen's University Facility Accessibility Design Standards
- d) ASHRAE 90.1

1.2. As part of 66% design submissions, reflected ceiling plans as well as photometric design shall be submitted for all projects as part of new or replacement lighting. For clarity this includes all interior and exterior lighting designs.

1.3. LED Luminaires and drivers must have a minimum 5 year warranty. The warranty should include the replacement of all fixtures if more than 15% of the fixtures fail within the first 5 years.

2. Interior Lighting

2.1 Indoor Colour Temperature: 3500 K unless otherwise stated.

2.2 Ultraviolet filters are required in art galleries, rare book collections and throughout the space occupied by the art department where fluorescent lamps are present.

2.3 Task lighting must be considered for the following spaces:

- a) Classroom chalkboard
- b) Office Desk
- c) Lab Benches

2.4 Unless information is given by the architect to the contrary, lighting design shall be based on the following reflection coefficients:

- | | | |
|----|-----------------|---------------|
| a) | Ceilings | 80% |
| b) | Walls | 50-60% |
| c) | Desk Tops | 35-40% |
| d) | Floor coverings | 30% or higher |

2.5 Spaces shall be designed to optimize reflection coefficients for high reflectivity without visual impairment.

3. **Luminaires**

3.1 Installation for major renovations or new builds shall use new LED type fixtures. Where appropriate, dimmable LED fixtures shall be installed. See section 4.9 for a list of spaces where dimming is required.

3.2 All new builds and major renovations shall only use 120 VAC to drive fixtures.

3.3 A sample fixture shall be purchased for all new lighting designs.

3.4 Custom-made fixtures should be avoided whenever possible.

3.5 For new builds and major renovations, the supplier & manufacturer shall demonstrate experience in manufacturing and implementing LED lighting equipment by providing:

- a) Information on a minimum of at least 3 other projects of similar scope
- b) Contact information for at least one other customer who has used the proposed fixtures

3.6 Acceptable Manufacturers for LED fixtures are as follows:

- a) Cree

- b) Phillips
- c) Leviton
- d) Eaton/Cooper
- e) Visioneering
- f) Sylvania
- g) Acuity brands

3.7 Fixture part numbers must be chosen from the Design Lights Consortium Qualified Products List.

3.8 Specifications for LED integrated fixtures:

- a) All fixtures shall be either 1x4', 2x4' or 2x2'
- b) All fixtures shall be either stem mounted, wall mounted, lay-in or surface mounted
- c) New fixtures have a semi-circular basket lens.

3.9 Specifications requirements for LED Drivers:

- a) Total Harmonic Distortion < 10%
- b) Drivers must limit inrush current
- c) Must be rated for > 50,000 hours
- d) Power supplies must be capable of operation at 60 Hz with PF of 90% or better

3.10 LED Fixtures must have a replaceable driver.

3.11 Installation of lighting upgrade within existing buildings may use a combination of T8 LED tube retrofits and replacement LED fixtures. The decision-making guideline for selecting options is as follows:

- a) Option 1: When fixtures are in good condition, dimming is not required, and the existing layout is still appropriate for the space use, the recommended approach is to replace the existing fluorescent tubes with LED (“Type A” retrofit)
- b) Option 2: When lighting is distributed well throughout the room but fixtures may be of an older style or have visible damage, remove the fixture and replace with a new integrated LED fixture or type C LED tube.
- c) Option 3: Where upgrading the existing layout to LED would unacceptably alter the even distribution of light, or when control systems such as occupancy sensors are missing from an area that should have them, a lighting redesign is recommended.

4. Lighting Controls

4.1 Lighting controls systems shall favor maintainability and longevity over complex functionality.

4.2 Building-level lighting control systems can be installed when deemed appropriate (i.e. according to building type/occupancy); however, they shall only be used to control lighting in common spaces such as hallways, atriums, and entrances. Where building-level lighting controls are utilized, a computer (with the lighting software installed), used to interface with the lighting control system, must be provided and connected to the Queen’s network via Ethernet to ensure remote accessibility.

4.3 Building/floor-level lighting control systems shall be centralized such that lighting relays and dimming modules are centralized in panels within electrical rooms/closets (or other similar non-public spaces). Switched power and/or 0-10VDC dimming signals shall come from these centralized panels to the individual light fixtures. Each centralized panel will power/control light fixtures for multiple areas within a floor, an

entire floor or multiple floors depending on the building. Light switches, occupancy sensors, etc. are to be hard-wired to the lighting control system (i.e. not wireless communication nor battery-powered) and are not to use specialized cabling, tools, or knowledge to maintain or replace the devices within the system. Approved manufacturers: Leviton, Lutron, or other approved by PPS Engineering.

4.4 Addressable fixtures, ballasts, and drivers shall not be used.

4.5 Where dimming is required, LED fixtures shall be controlled by a 0-10 VDC dimming control system.

4.6 Wireless controls shall not be used.

4.7 Room lighting will be controlled by wall switches, with dimming and occupancy sensing as appropriate.

4.8 In spaces that require an in-room audio visual presentation system or areas that require specialized lighting control, the Lutron GRAFIK Eye shall be used. Other systems shall not be used unless explicitly approved by PPS Engineering. See item 4.3 for system architecture.

4.9 All new builds or major renovations shall have a dimming range of at least 20-100% in the following spaces:

- a) Lecture Theatres

- b) Performance Halls
- c) Classrooms
- d) Study Spaces
- e) Conference Rooms

4.10 In areas with multiple lighting circuits, each circuit shall power alternating fixtures rather than each circuit powering a large grouping of fixtures. This is done to provide a way to dim room lighting by turning off different circuits.

4.11 In spaces requiring dimmable fixtures and occupancy sensing, a wall switch, power pack and wall or ceiling occupancy sensor shall be used. The acceptable manufacturers are outlined below

- a) Lutron
- b) Leviton
- c) Or other approved by PPS Engineering

4.12 When common areas and corridor lighting are programmed or turned “off” after-hours, certain light fixtures shall remain on, conforming to the minimum lighting requirements as per the Ontario Building Code. Where feasible, these fixtures should also form the emergency lighting system. In those spaces where emergency light fixtures are installed but are switched off or dimmed due to audio/visual presentations, etc., then the lighting control system will immediately turn these emergency light fixtures on to full brightness. The lighting controls system must be approved for this function. ULC-approved relays can also be used to automatically power on fixtures to full illumination in case of power failure.

4.13 No lighting components shall contain batteries except for emergency lighting unit equipment or central inverters unless explicitly approved by PPS Engineering.

4.14 Occupancy based dimming must use either ultrasonic or dual tech (ultrasonic and infrared) sensors.

4.15 Occupancy sensors shall be applied in the following spaces and the time delay shall be set to the following values below:

a)	Classroom	30 minutes
b)	Office	30 minutes
c)	Storage room	20 minutes
d)	Study Rooms	30 minutes
e)	Washrooms	30 minutes
f)	Gymnasium	30 minutes
g)	Parking Garages	20 minutes
h)	Hallways and Corridors	20 minutes
i)	Stairwells	20 minutes
j)	Or other approved by PPS Engineering	

4.16 Daylight sensing shall be used in appropriate areas only when the total light usage can be offset by more than 1000 hours in a year.

- 4.17 Service rooms (i.e. electrical room, mechanical room, elevator machine room, etc.) shall have locally switched lights. (i.e. no occupancy or vacancy sensor or remote-controlled light from lighting control system, etc.)

5. Emergency/Exit Lighting

- 5.1 Emergency/exit lighting shall be powered from the building or area standby generator. When there is no building or area standby generator, emergency/exit lighting shall be fed from a central, battery-backed inverter. Where there is no inverter, or installing an inverter is not feasible, emergency/exit lighting fixtures shall have battery packs. Consultants MUST confirm with PPS Engineering whether the building has access to emergency power or whether the emergency/exit light fixtures must be battery-powered.
- 5.2 Unit equipment for emergency/exit lighting shall be selected for optimum life cost, maintenance being of utmost consideration. Automatic controls shall be provided for charging at both high and low rates. Meters/monitors shall be provided to indicate charge rate and condition. Lamp heads shall be of LED type.
- 5.3 Unit equipment output voltage shall normally be rated 24 VDC.
- 5.4 Commissioning of emergency lighting shall include recording the illumination levels achieved for all areas where provided.
- 5.5 Fixtures (other than battery unit type) used for emergency lighting shall be marked with a visible label indicating that it is an emergency lighting fixture.

5.6 Exit lights shall be LED-type, shall be robust for any student-intensive areas (i.e. Student Residences, etc.) and must be solidly-mounted to the building structure.

5.7 Documentation shall include manufacturer's operation instructions, maintenance instructions, catalogue cut sheets, data sheets, as-built floor plans, unique identification and listing of all emergency fixtures.

6. Exterior Lighting

6.1 Exterior lighting shall conform to the principles outlined in the Campus Master Plan (2014). The Campus Master Plan is available here:

<https://www.queensu.ca/strategicplanning/cmp>

6.2 Exterior fixtures shall be assigned unique numbers referred to as grid numbers.

6.3 Outdoor color temperature for lighting fixtures shall be between 2500 and 3000 K

6.4 Illuminance values for applications not included in the plan shall be based on the latest edition of the IES Lighting Handbook.

6.5 Documentation shall include manufacturer's catalogue cut indicating specific fixture and options, fixture designation and quantity specified.

6.6 Pedestrian walkway fixtures, poles and lamps shall be heritage poles. Acceptable product numbers that meet the heritage pole specifications are outlined below:

Holophane Luminaire Top	GVD3 P10 30K MVOLT MS GL5 BRUSHED GREY ST AO 360 HSS PERF
Holophane Luminaire Pole	NY – A – 10 – F4C – 17 – P07- ABG – BRUSHED GREY

DIVISION 26 00 00

Electrical



HCI Luminaire Top	F111-S-Q-EGL-55-120V-IES type III-FA- BRUSHED GREY
HCI Luminaire Pole	P452 –BRUSHED GREY– PF280 – G5

6.7 Heritage pole tops and poles shall not be interchanged between manufacturers.
(Example: An HCI top shall not be purchased with a Holophane pole)

6.8 All heritage pole products must also meet the following specifications. Alternative heritage pole products will be considered if they can adhere to these requirements:

- a) Lumen output of 3600 Lumens. Heritage poles with a lumen output greater than 3600 lumens must be capable of dimming to reduce glare and light intensity.
- b) Color temperature must be 3000K to meet dark sky compliance regulations
- c) Lifespan must be > 50,000 hours
- d) Mesh shielding and downwards reflectors are required on the light source
- e) For sidewalk lighting, Type 3 distribution is required. For general area lighting, Type 5 distribution is required
- f) A minimum efficacy of 66 Lumens/Watt is required for induction bulbs (55 W or better). A minimum efficacy of 109 Lumens/Watt is required for LEDs.
- g) Pole must be similar in appearance to those existing on campus
- h) Pole base must be 17-21 inches x 25-31 inches.
- i) Pole base must have a 4 bolt anchoring pattern
- j) Pole height must be 10 ft, fluted to a 3 inch Tenon
- k) Fixture necking must be compatible with Tenon on pole.
- l) Pole must have 10-12 flutes.
- m) Pole base and collar must be cast aluminum
- n) Pole shaft must be cast or extruded aluminum
- o) Pole must have a uniform thickness of 0.125 inches or better
- p) Pole, collar and base must be colour matched to existing poles.

- q) Paint on pole, top lens and collar must be electrostatically applied thermoset polyester powder coat with smooth semi-gloss finish.
- r) Glass lens must have finial similar in size and shape to existing.
- s) Collar must fit 3" Tenon.

7. Lighting for Assistance Phones

7.1 The acceptable product manufacturer for all assistance phones related products is Code Blue.