NRC Canadian Codes Centre

2011 National Energy Code for Buildings (NECB) – Lighting

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Canada

Introduction

- Presentation is part of a series of seven
- Model code developed by Canadian Commission on Building and Fire Codes
- NECB must be adopted by provincial/territorial authorities to become law

Outline

- Scope
- Compliance options
- Exterior lighting – prescriptive path
- Interior lighting – prescriptive path
  - Building area method
  - Space-by-space method
- Interior lighting trade-off path
- Performance path

Scope

- Applies to lighting components and systems connected to building's electrical service
- Exemptions:
  - Emergency lighting automatically off during normal building operation
  - Lighting in dwelling units
  - Where impractical
- Similar to ASHRAE 90.1-2010 in content

Compliance options

- Prescriptive
- Interior lighting trade-off
- Performance compliance

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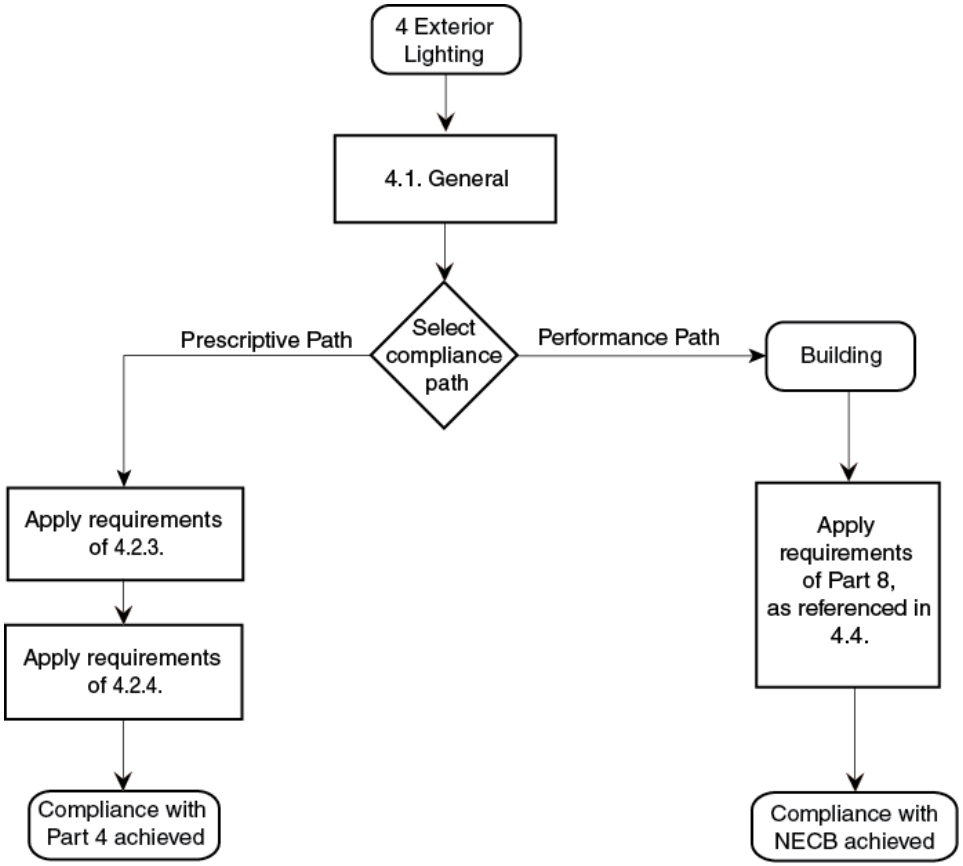
Exterior lighting – options

- Prescriptive or performance compliance only
- For systems connected to building's electrical service

Exterior lighting – options



Exterior lighting – prescriptive: compliance equations

- **Step 1:**
  Total connected power for specific applications ≤ Specific application allowance + basic site allowance

- **Step 2:**
  Total connected power for general applications ≤ General application allowance + unused basic site allowance from Step 1

Exterior lighting – prescriptive: exclusions

Specialized signal, directional, and marker lighting associated with transportation	Lighting for industrial production, material handling, transportation sites, and associated storage areas for industrial sites
Advertising signage and directional signage	Temporary lighting
Lighting integral to equipment or instrumentation and installed by its manufacturer	Lighting for theme elements in theme/amusement parks
Lighting for theatrical purposes, including performance, stage and film and video production	Lighting used to highlight features of art objects, public monuments and designated national or provincial historic sites
Lighting for athletic activity areas	

Exterior lighting – prescriptive: controls

- Control types
  - Dusk-to-dawn → astronomical time control or photosensor
  - Other → astronomical time control, photosensor, photosensor and time switch, or equivalent
- Exemptions
  - Covered vehicle exterior entrances
  - Exterior exits from buildings
  - Parking structures where needed for safety, security or eye adaptation

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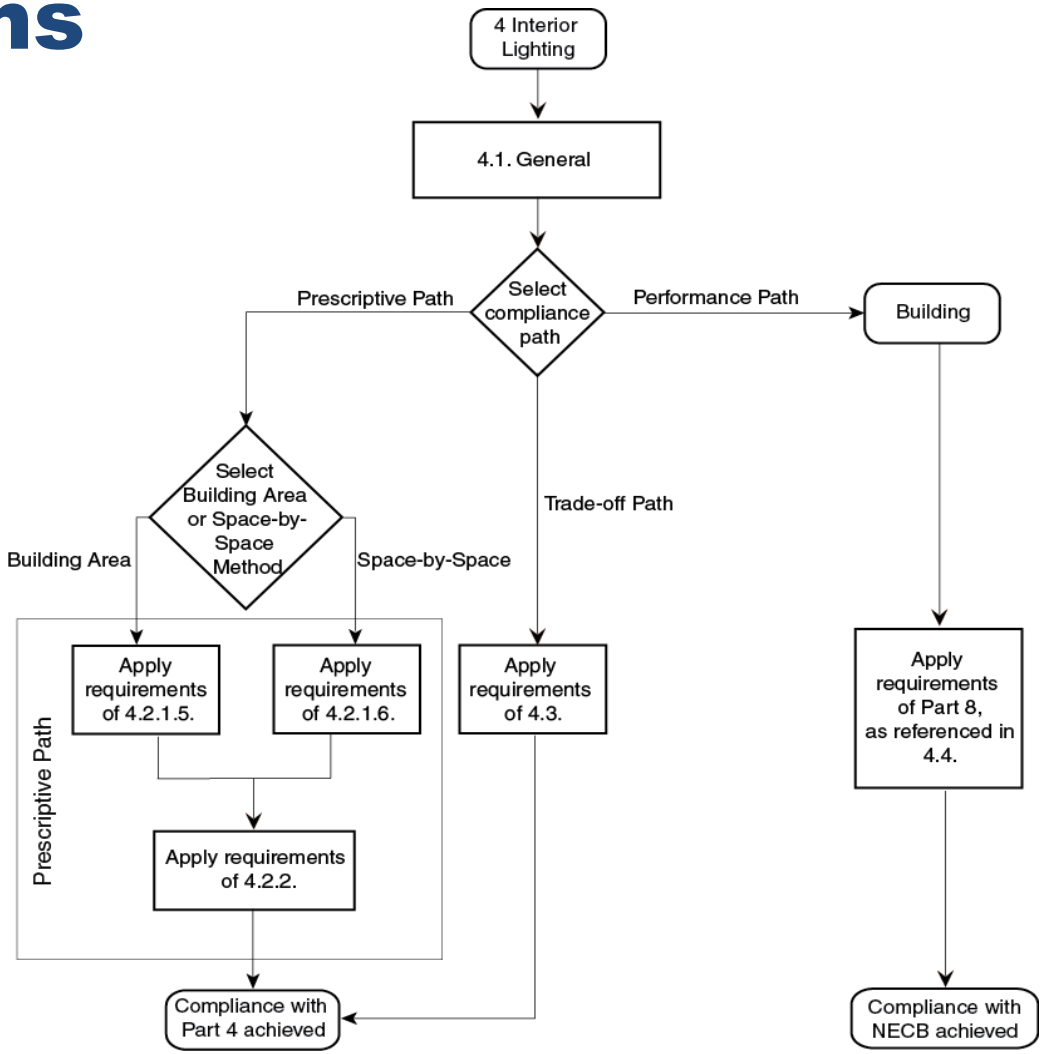
Interior lighting – compliance options

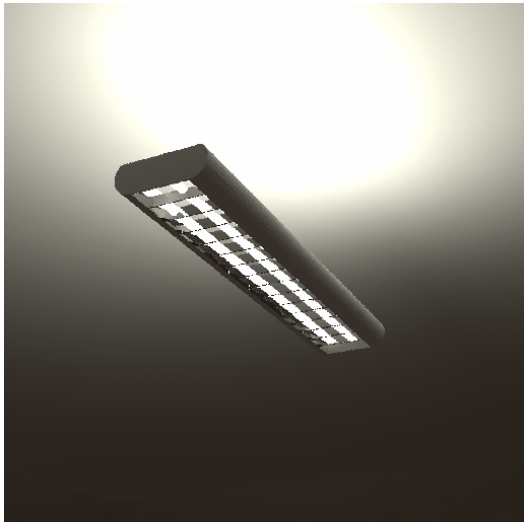


Interior lighting – prescriptive: compliance equation

- Installed interior lighting power cannot exceed interior lighting power allowance as determined by either
  - Building area method, or
  - Space-by-space method
- Methods can't be mixed

Interior lighting – prescriptive: installed interior lighting power

- Includes
  - All power used by luminaires to provide both permanent and supplemental lighting, including movable or plug-in luminaires
  - Higher wattage when more than one system provides lighting to an area at different times



Interior lighting – prescriptive: installed interior lighting power

- Exemptions

Lighting for TV broadcasting in sporting activities	Lighting for retail or educational demonstration
Lighting integral to equipment	Casinos
Lighting used during medical or dental procedures	Lighting in retail displays in fully enclosed spaces
Lighting integral to refrigerator and freezer cases	Special lighting for visually impaired and other conditions
Lighting integral to food warming and food preparation	Lighting integral to advertising or directional signs
Lighting for plants	Exit signs
Lighting in historic landmarks	Lighting for theatrical purposes
Mirror lighting in dressing rooms	Accent lighting in religious areas
Display or accent lighting essential for galleries, museums, monuments	Where it can be shown that the inclusion will adversely affect the intended function or use

Interior lighting – prescriptive: building area method

- Interior Lighting Power Allowance – building area method:
  - Select building type or equivalent from table based on primary use
  - Multiply lighting power density by gross lighted area to get interior lighting power allowance
  - If 10% or more of gross lighted area can be classified as another type, space-by-space method must be used
  - If no equivalent, space-by-space method must be used

Interior lighting – prescriptive: space-by-space method

- Interior Lighting Power Allowance – space-by-space method:
  - Apply to each enclosed space
    - Find lighting power density listed in table based on use of space or equivalent
    - Multiply lighting power density by gross interior floor area of space
  - Sum results for all spaces

Interior lighting – prescriptive: controls

- Automatic shut-off
  - Time-of-day operation
  - Occupant sensor
  - Signals that area is unoccupied
- Exemptions
  - 24-hour operation
  - Patient care areas
  - Safety or security issues

Interior lighting – prescriptive: controls for spaces

- At least one control for general lighting in enclosed spaces
- Spaces listed below must have occupant sensor (automatic control)

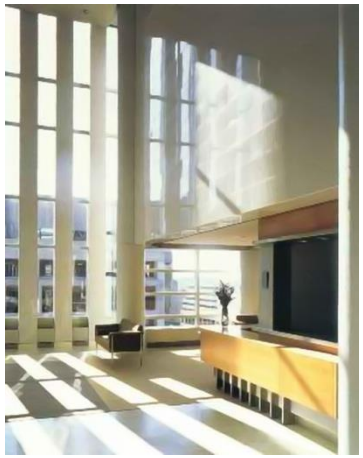
Classrooms and lecture halls, excluding shop and laboratory classrooms	Conference, meeting and training rooms
Employee lunch and break rooms	Storage and supply rooms up to 100 m^2
Copying and printing rooms	Dressing, locker and fitting rooms
Offices up to 25 m^2	Washrooms

Interior lighting – prescriptive: automatic daylighting controls for toplighting

- Daylighted area > 400 m^2 → photocontrol to reduce general lighting
- Exemptions
  - Light blocked
  - Insufficient skylight aperture
  - Small enclosed space above 55ºN latitude
- Requirements on how to calculate daylighted area

Interior lighting – prescriptive: automatic daylighting controls for sidelighting

- Sidelighted area > 100 m^2 → photocontrol to reduce general lighting
- Exemptions
  - Light blocked by adjacent building
  - Insufficient sidelight aperture
  - Retail spaces
- Requirements on how to calculate sidelighted area



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Trade-off path

- Part specific
- Applies to interior lighting only
- Installed Interior Lighting Energy (IILE) ≤ Interior Lighting Energy Allowance (ILEA)
- ILEA calculated in accordance with prescriptive space-by-space method

Trade-off path

- More detailed calculation → series of equations to calculate ILEA and IILE

$$ILEA = \sum_{i=1}^{N} E_{i,\,prescriptive} \qquad IILE = \sum_{i=1}^{N} E_{i,\,proposed}$$

$$E_{i,proposed} = p_i \cdot \left[A_{DL,i} \cdot \left(t_{eff,day,DL,i} + t_{eff,night,i} \right) + A_{NDL,i} \cdot \left(t_{eff,day,NDL,i} + t_{eff,night,i} \right) \right]$$

$$t_{eff,day,DL,i} = t_{day,i} \cdot F_{DL,i} \cdot F_{occ,i} \cdot F_{pers,i} \qquad t_{eff,day,NDL,i} = t_{day,i} \cdot F_{occ,i} \cdot F_{pers,i}$$

$$t_{eff,night,i} = t_{night,i} \cdot F_{occ,i} \cdot F_{pers,i} \quad \ldots$$

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Performance compliance limitations

- NECB Part 4 Lighting → no limitations

Questions?

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Thank you