107- Introduction to Codes and Standards

Presented by

Eric Strandberg LC, MIES

Sr Lighting Specialist

Fall 2020

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Before we begin...

During the Webinar

- Attendees will be muted
- Please use the chat feature in the control panel to submit questions to LDL staff
- The presenter will pause to address questions every ~10 minutes
- Please participate in the online polls.

Following the Webinar

- Please take the short survey
- A recording and the slide deck will be posted on LDL's webpage
- Reach out to LightingDesignLab@seattle.gov with comments or questions.

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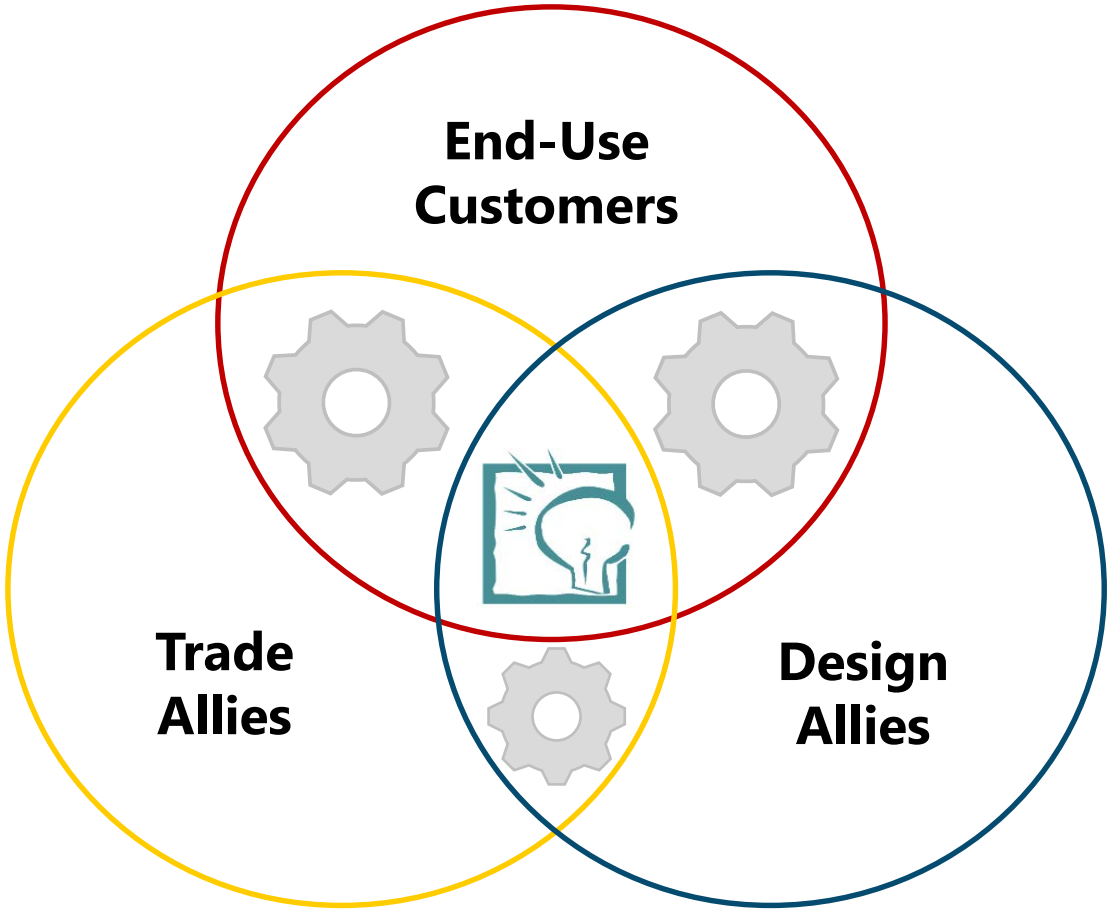
Who We Work With

It takes a village…



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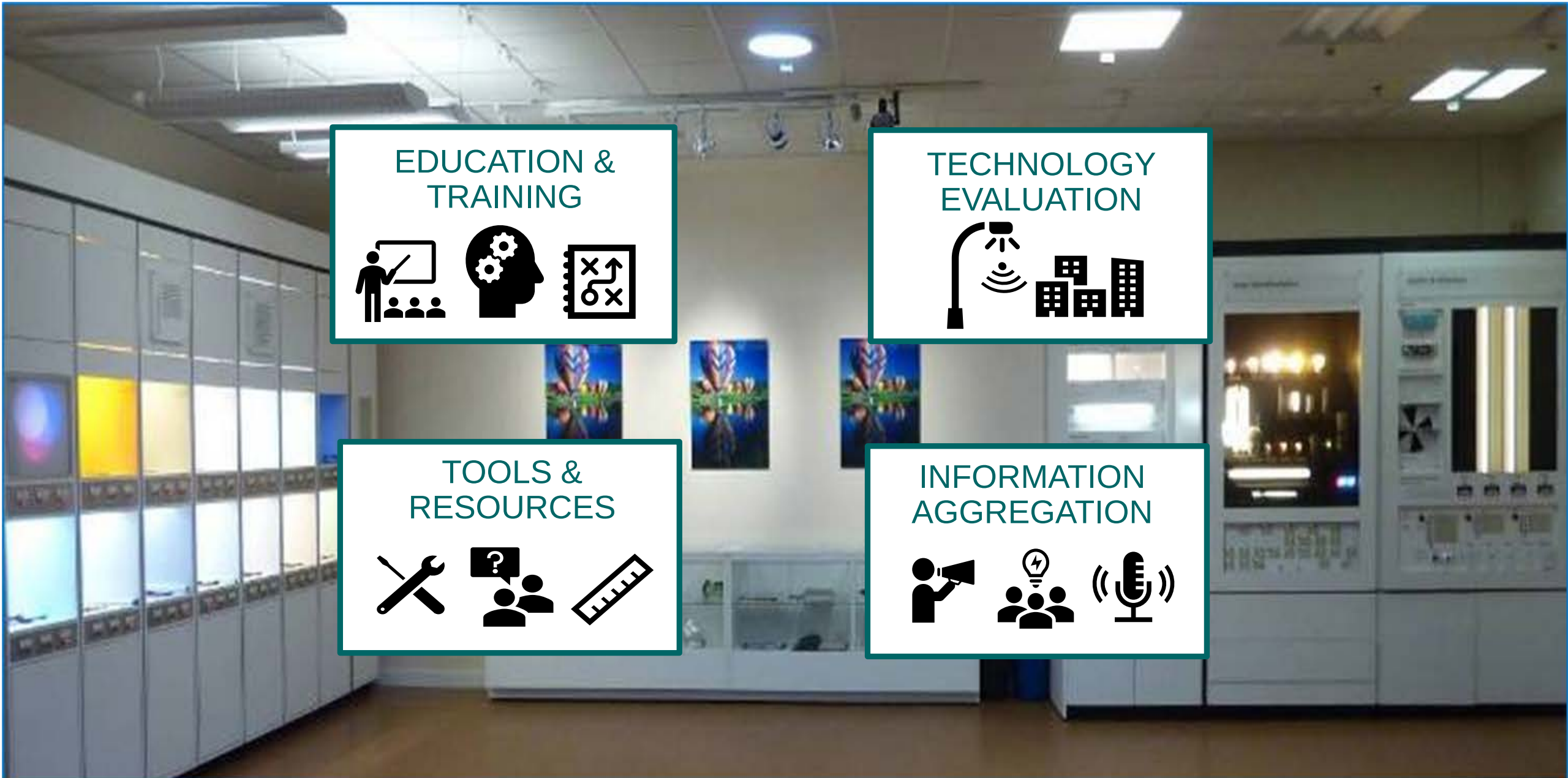
LDL’s Four Core Service Areas



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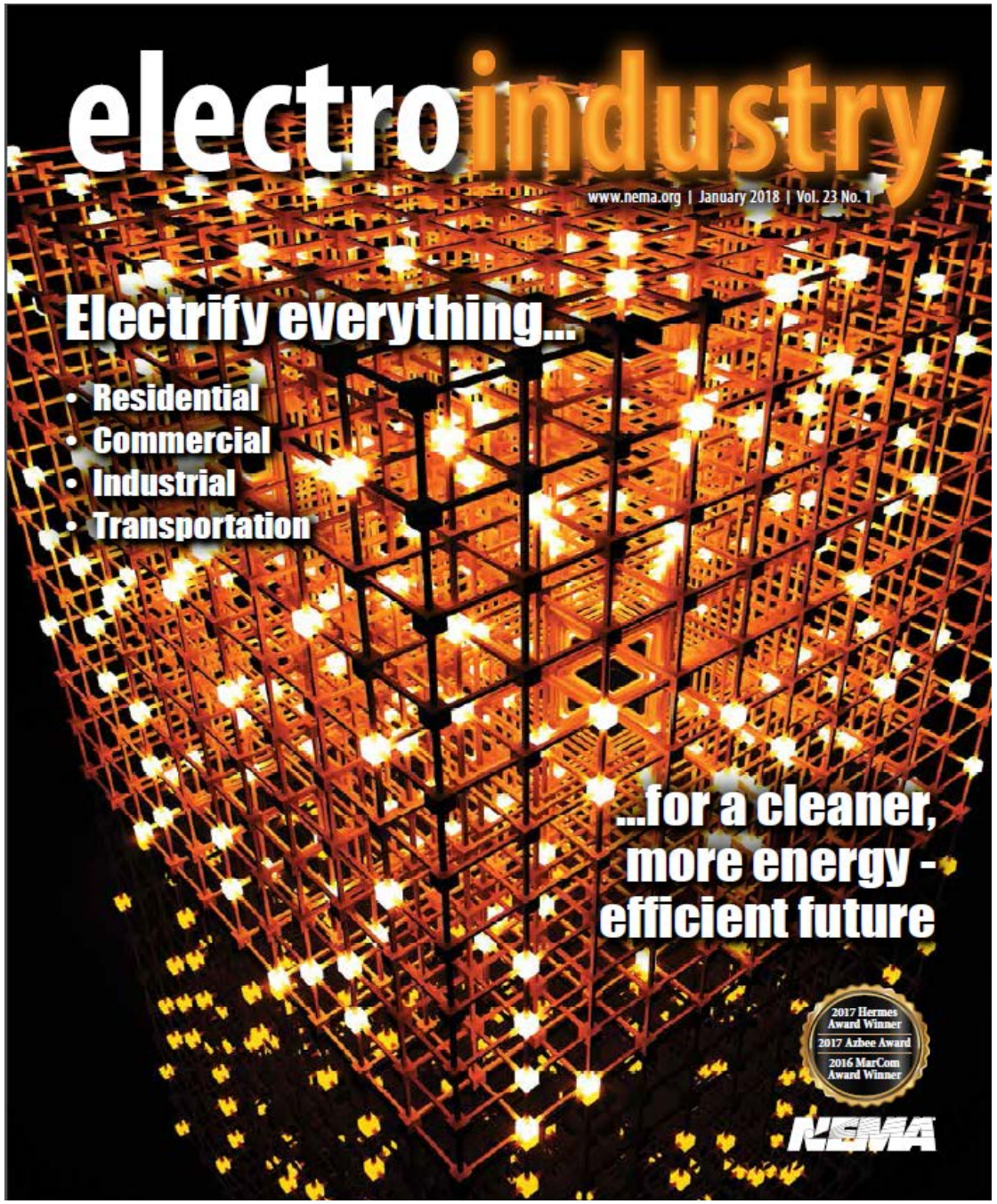

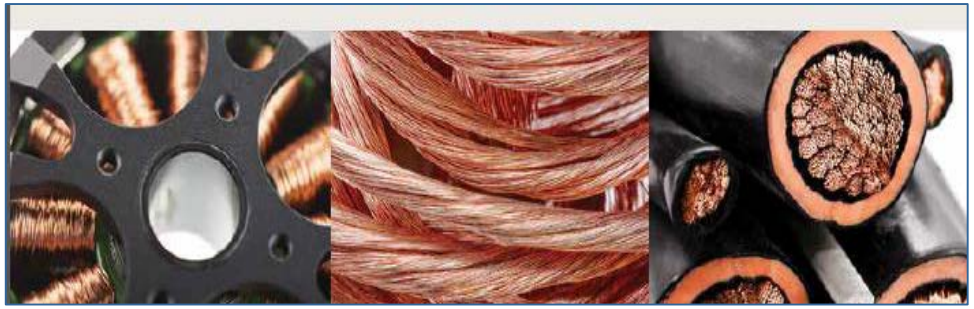

Copper Development Association
Copper Alliance

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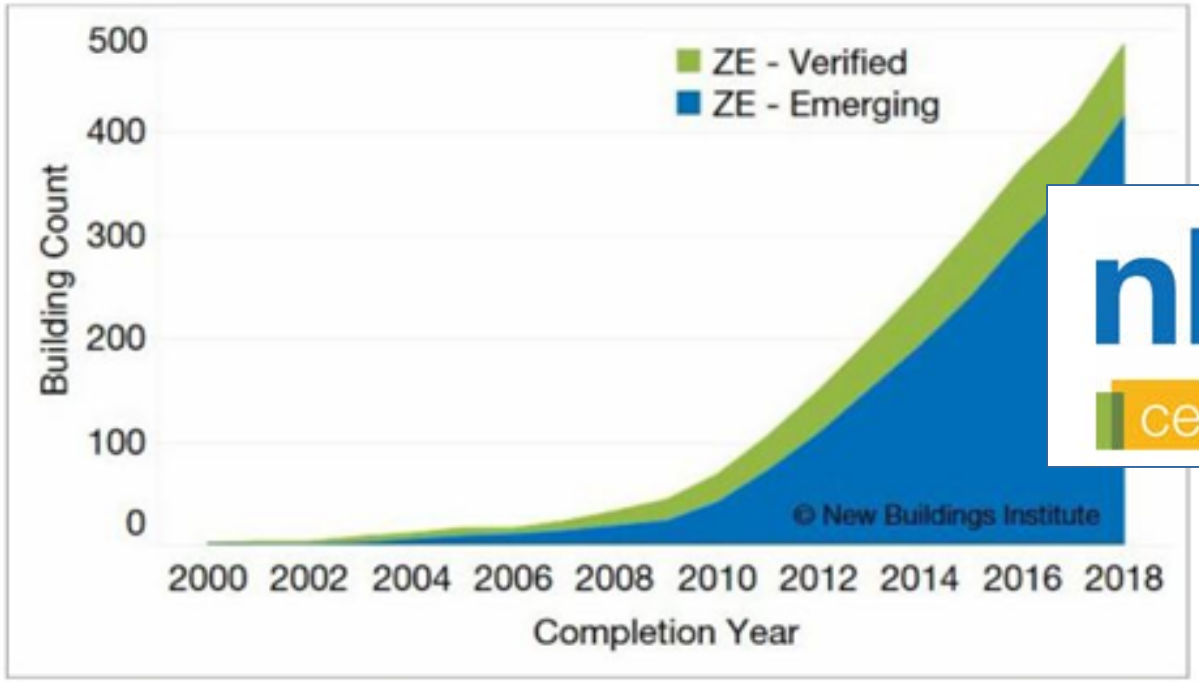
Private sector investments contribute to over 700% growth in zero energy buildings market since 2012

New Buildings Institute's (NBI) 2018 zero energy buildings list includes nearly 500 verified and emerging zero energy (ZE) buildings across the United States and Canada--a 700 percent increase since NBI began tracking projects in 2012, with private sector investment now representing nearly half of all buildings on the list. ZE buildings are ultra-low energy buildings that consume only as much energy as is produced through renewable generation resources. The list is part of the *2018 Getting to Zero Status Update and ZE Buildings List* that NBI officially released today.



nbi new buildings institute
celebrating 20 YEARS

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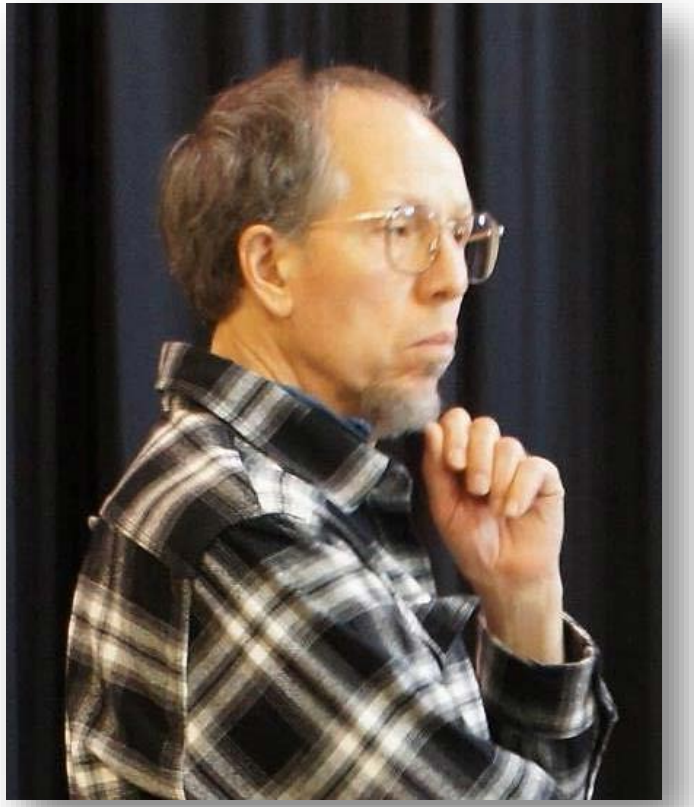

eric@lightingdesignlab.com

Since 1995 Eric Strandberg LC, has been one of the lighting specialists at the Lighting Design Lab promoting energy efficiency and quality lighting design. With a passion for “all things lighting”, he has over 30 years in the lighting industry. This work encompasses almost every aspect of lighting design and conservation including; developing and presenting classes, writing articles, technology evaluation and project consultation.

Pop Quiz- Who are you and why are you here?

- New to lighting and confused by all the codes.
- Do lots of lighting, but rarely need to address code issues.
- Want to learn what is new with WSEC.
- I am a code official.
- Just want CEUs.

Today’s Learning Outcomes

- A basic understanding of why there are codes and standards.
- The importance of identifying the AHJ.
- An overview of the WSEC.
- An introduction to LEED and WELL

What influences lighting choices?

Design team (Internal)

- Design criteria
- Stakeholder input
- Budget

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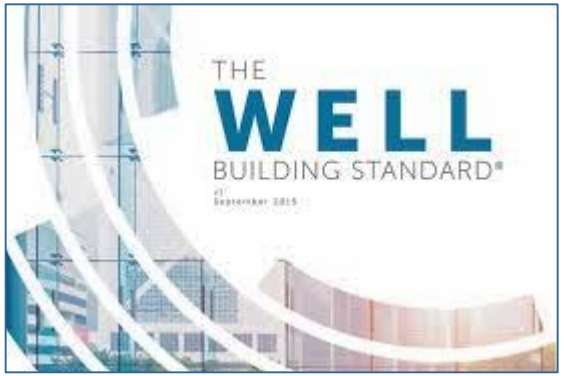
What influences lighting choices?

Outside influences (Voluntary)

- LEED
- WELL Building
- Utility Incentive
- Dark Sky
- IES *Recommended* Practice



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What influences lighting choices?

Outside influences (Mandatory)

- Life Safety Code (NFPA)
- National Electrical Code
- OSHA
- ADA
- D O Health
- State/Local Codes and Ordinances (WAC)
- UL/ETL/CSA
- **Energy Code**
- **AHJ**

Authority Having Jurisdiction- **AHJ**

The authority having jurisdiction (AHJ) is that person or office charged with enforcing the **Life Safety Code**. In many states the AHJ is the state fire marshal who has local inspectors work on his/her behalf. ***For some occupancies, there is more than one AHJ***; each AHJ's approval must be secured. **For example**, the authorities having jurisdiction for a hospital might include: state fire marshal; building official; fire department fire prevention officer; state health care licensing agency; The Joint Commission; U.S. Department of Health and Human Services – Centers for Medicare and Medicaid Services (CMS); and the facility's insurance carrier. **If you're unsure who the AHJ is, contact your state fire marshal.**

http://www.wsp.wa.gov/fire/for-businesses/

The SFMO provides plan review and inspection services of state funded public school construction projects. The SFMO only provides these services when a local jurisdiction does not have access locally – typically rural communities that do not have a lot of construction projects, or upon request. **All plan review projects for fire and life safety are in accordance with the state adopted International Codes.**

Authority Having Jurisdiction- AHJ

Electrical Construction & Maintenance (EC&M) magazine — published monthly since 1901

Who has the final say when there's a Code conundrum?

Eddie Guidry | May 21, 2015

In Art. 100 of the 2014 National Electrical Code (NEC), the term Authority Having Jurisdiction (AHJ) is defined as "An organization, office, or individual responsible for enforcing the requirements of a code or standard, or for approving equipment, materials, an installation, or a procedure."

For residential and light commercial projects within a governmental jurisdiction, such as a city or state, the governmental inspector will most likely be the primary AHJ. *For large industrial facilities, many times located outside of a local governmental jurisdiction, identifying the AHJ can be more challenging.* ***For most industrial plants in the United States, the primary AHJ is typically the owner company and its appointed engineer(s).***

OSHA Occupational Safety and Health Administration

In summary, while the local AHJ has a lot of authority, in the end they can be overridden by OSHA inspectors and OSHA regulations. This is important to keep in mind, especially in cases where NEC special permission or waivers have been granted by the local AHJ.

Authority Having Jurisdiction- AHJ

The phrase “authority having jurisdiction,” or its acronym AHJ, is used in NFPA documents in a broad manner, since jurisdictions and approval agencies vary, as do their responsibilities. *Where public safety is primary, the authority having jurisdiction may be a federal, state, local, or other regional department or individual such as a fire chief; fire marshal; chief of a fire prevention bureau, labor department, or health department; building official; electrical inspector; or others having statutory authority.*

For insurance purposes, an insurance inspection department, rating bureau, or other insurance company representative may be the authority having jurisdiction.

In many circumstances, the **property owner or his or her designated agent assumes the role of the authority having jurisdiction**; at government installations, the commanding officer or departmental official may be the authority having jurisdiction.

Building Codes and Barrier-Free Design AHJ

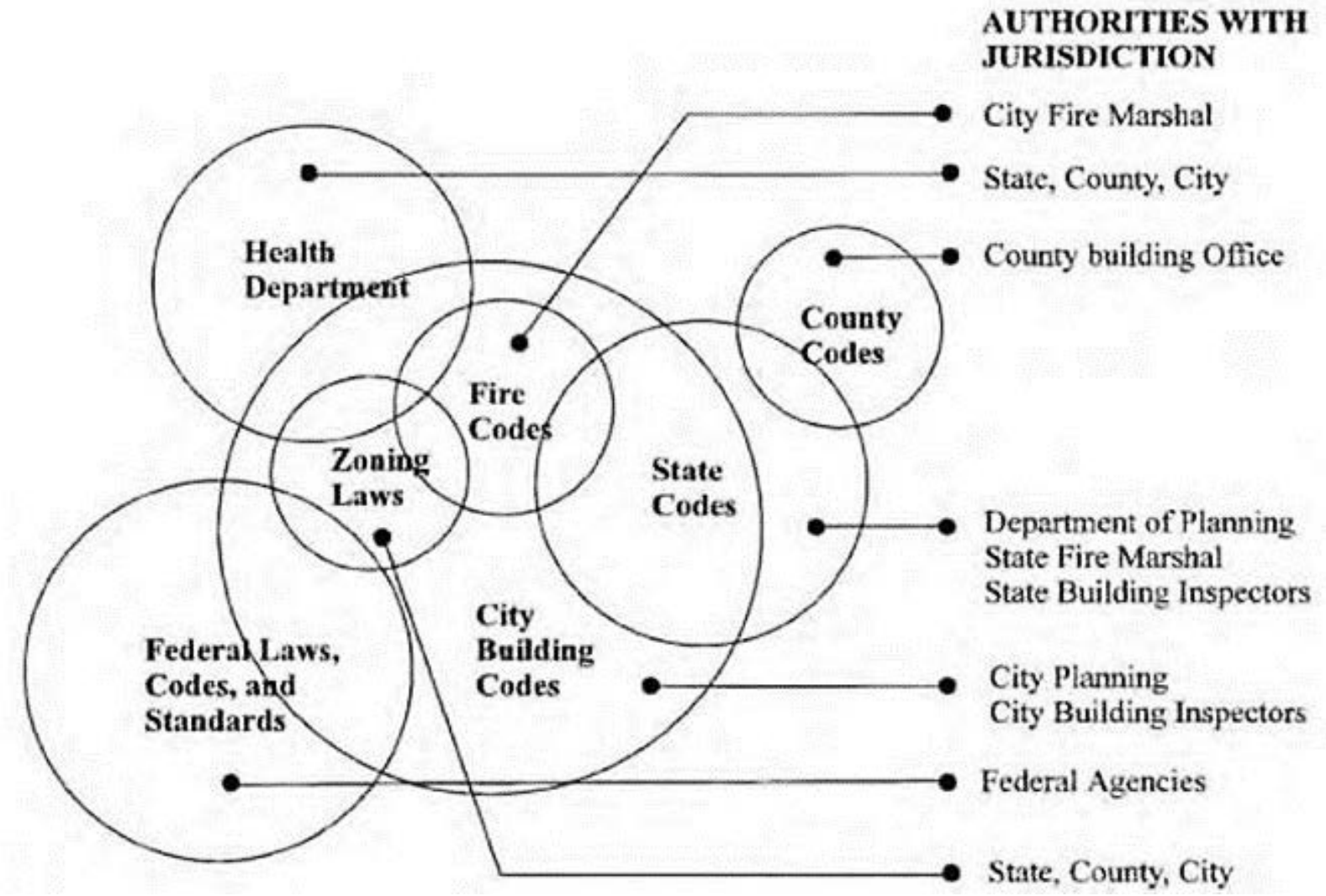
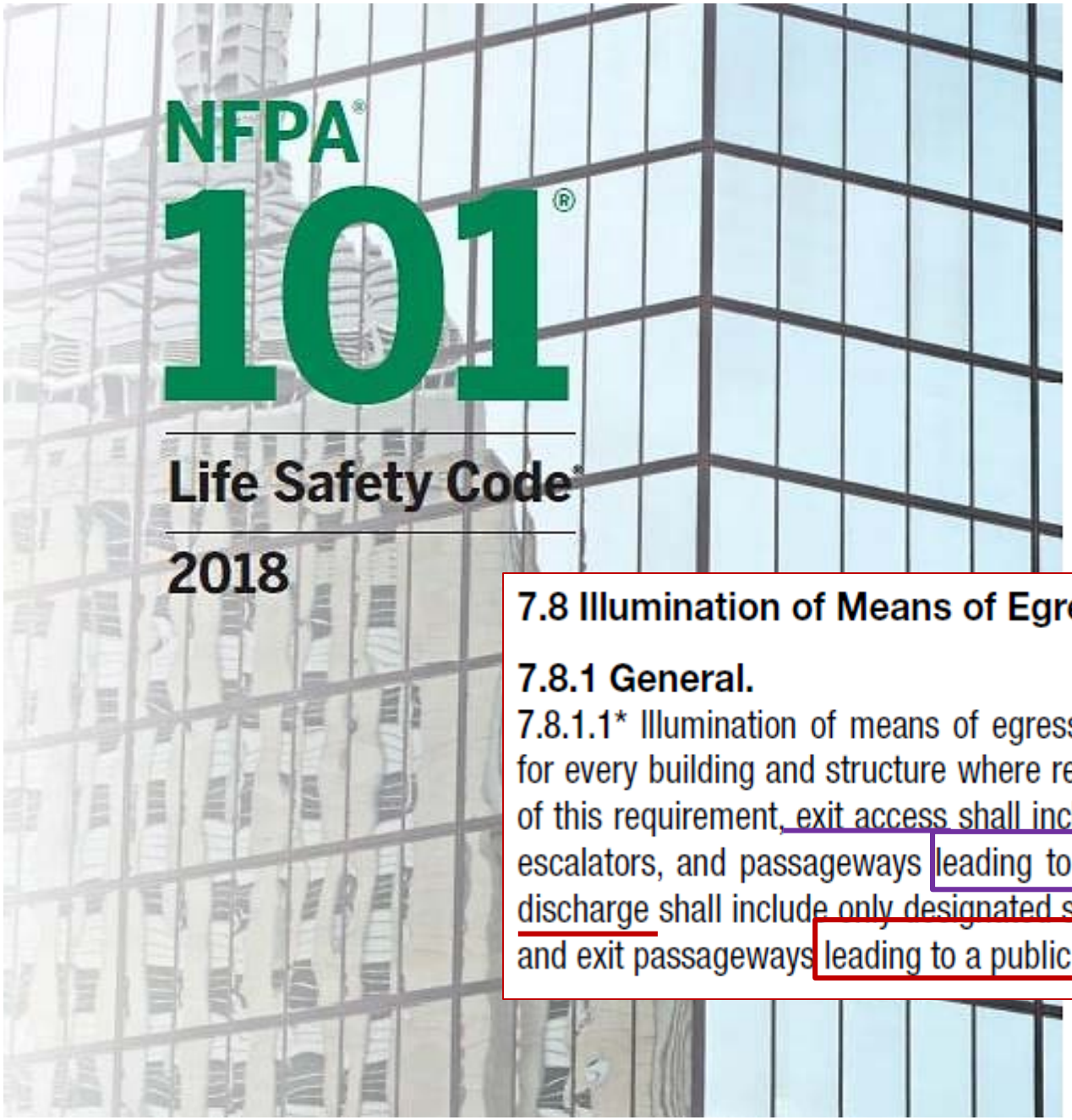


Figure 11.1 Illustration showing overlapping code structure and complexity of current regulations (source: Specifications for Commercial Interiors by S.C. Reznikoff).



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7.8 Illumination of Means of Egress.

7.8.1 General.

7.8.1.1* Illumination of means of egress shall be provided in accordance with Section 7.8 for every building and structure where required in Chapters 11 through 43. For the purposes of this requirement, exit access shall include only designated stairs, aisles, corridors, ramps, escalators, and passageways leading to an exit. For the purposes of this requirement, exit discharge shall include only designated stairs, aisles, corridors, ramps, escalators, walkways, and exit passageways leading to a public way.

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7.8.1 General.

Δ **7.8.1.1*** Illumination
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7.8.1.2 Illumination o
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7.8.1.2.1 Artificial ligh
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7.8.1.2.2* Unless proh
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(1) In new installation
(2) The lighting cont
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and is evaluated f
(3) Illumination time
mum 15-minute d
(4) The lighting cont
movement in the
(5) In new installations, the lighting control device is activated by activation of the building fire alarm system, if provided.
(6) The lighting control device does not turn off any lights relied upon for activation of photoluminescent exit signs or path markers.
(7) The lighting control device does not turn off any battery-equipped emergency luminaires, unit equipment, or exit signs.

7.8.1.2.3* Energy-saving sensors, switches, timers, or controllers shall be approved and shall not compromise the continuity of illumination of the means of egress required by 7.8.1.2.

7.8.1.3 The floors and other walking surfaces within an exit and within the portions of the exit access and exit discharge designated in 7.8.1.1 shall be illuminated as follows:

(1) During conditions of stair use, the minimum illumination for new stairs shall be at least 10 ft-candle (108 lux), measured at the walking surfaces.
(2) The minimum illumination for floors and other walking surfaces, other than new stairs during conditions of stair use, shall be to values of at least 1 ft-candle (10.8 lux), measured at the floor.
(3) In assembly occupancies, the illumination of the walking surfaces of exit access shall be at least 0.2 ft-candle

which the following also apply:

(a) The stair shaft and vestibule shall be permitted to include a standby generator that is installed for the smokeproof enclosure mechanical ventilation equipment.
(b) The standby generator shall be permitted to be used for the stair shaft and vestibule emergency lighting power supply.

(6) New sensor-release of electrical locking systems in accordance with 7.2.1.6.2

7.9.1.2 For the purposes of 7.9.1.1, exit access shall include only designated stairs, aisles, corridors, ramps, escalators, and passageways leading to an exit. For the purposes of 7.9.1.1, exit discharge shall include only designated stairs, ramps, aisles, walkways, and escalators leading to a public way.

7.9.1.3 Where maintenance of illumination depends on changing from one energy source to another, a delay of not more than 10 seconds shall be permitted.

7.9.2 Performance of System.

7.9.2.1 Emergency illumination shall be provided for a minimum of 1½ hours in the event of failure of normal lighting.

7.9.2.1.1 Emergency lighting facilities shall be arranged to provide initial illumination that is not less than an average of
lux) and, at any point, not less than 0.1 ft-
, measured along the path of egress at floor

nation levels shall be permitted to decline to
average of 0.6 ft-candle (6.5 lux) and, at any
han 0.06 ft-candle (0.65 lux) at the end of

naximum-to-minimum illumination shall not
40 to 1.

ergency power systems for emergency lighting
Type 10, Class 1.5, Level 1, in accordance with

ergency lighting system shall be arranged to
ired illumination automatically in the event of
of normal lighting due to any of the following:
public utility or other outside electrical power
a circuit breaker or fuse
(s), including accidental opening of a switch
normal lighting facilities

cy generators and related transfer switch
provide power to emergency lighting systems
inspected, tested, and maintained in accord-
110. Stored electrical energy systems, where
Code, other than battery systems for emergency
ordance with 7.9.2.5, shall be installed, inspec-
maintained in accordance with NFPA 111.

uipment and battery systems for emergency
be listed to ANSI/UL 924, *Standard for Emer-
l Power Equipment.*

battery-operated emergency lights shall use
s of rechargeable batteries provided with suit-
able facilities for maintaining them in properly charged condition. Batteries used in such lights or units shall be approved for their intended use and shall comply with *NFPA 70*.

7.9.2.7 The emergency lighting system shall be either continuously in operation or shall be capable of repeated automatic operation without manual intervention.

7.9.3 Periodic Testing of Emergency Lighting Equipment.

Δ **7.9.3.1** Required emergency lighting systems shall be tested in accordance with one of the four options offered by 7.9.3.1.1, 7.9.3.1.2, 7.9.3.1.3, or 7.9.3.1.4.

Δ **7.9.3.1.1** Testing of required emergency lighting systems shall be permitted to be conducted as follows:

Section 7.9.2 Performance of System:

7.9.2.1 Emergency illumination shall be provided for a minimum of 1-1/ 2 hours in the event of failure of normal lighting.

7.9.2.1.1 Emergency lighting facilities shall be arranged to provide initial illumination that is not less than an average of 1 ft-candle (10.8 lux) and, at any point, not less than 0.1 ft-candle (1.1 lux), measured along the path of egress at floor level.

7.9.2.1.2 Illumination levels shall be permitted to decline to not less than an average of 0.6 ft-candle (6.5 lux) and, at any point, not less than 0.06 ft-candle (0.65 lux) at the end of the 1-1/ 2 hours.

7.9.2.1.3 The maximum-to-minimum illumination shall not exceed a ratio of 40 to 1.

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7.8 Illumination of Means of Egress

7.8.1.2.3* Energy-saving sensors, switches, timers, or controllers shall be approved and shall not compromise the continuity of illumination of the means of egress required by 7.8.1.2.

7.8.1.3* The floors and other walking surfaces within an exit and within the portions of the exit access and exit discharge designated in 7.8.1.1 shall be illuminated as follows:

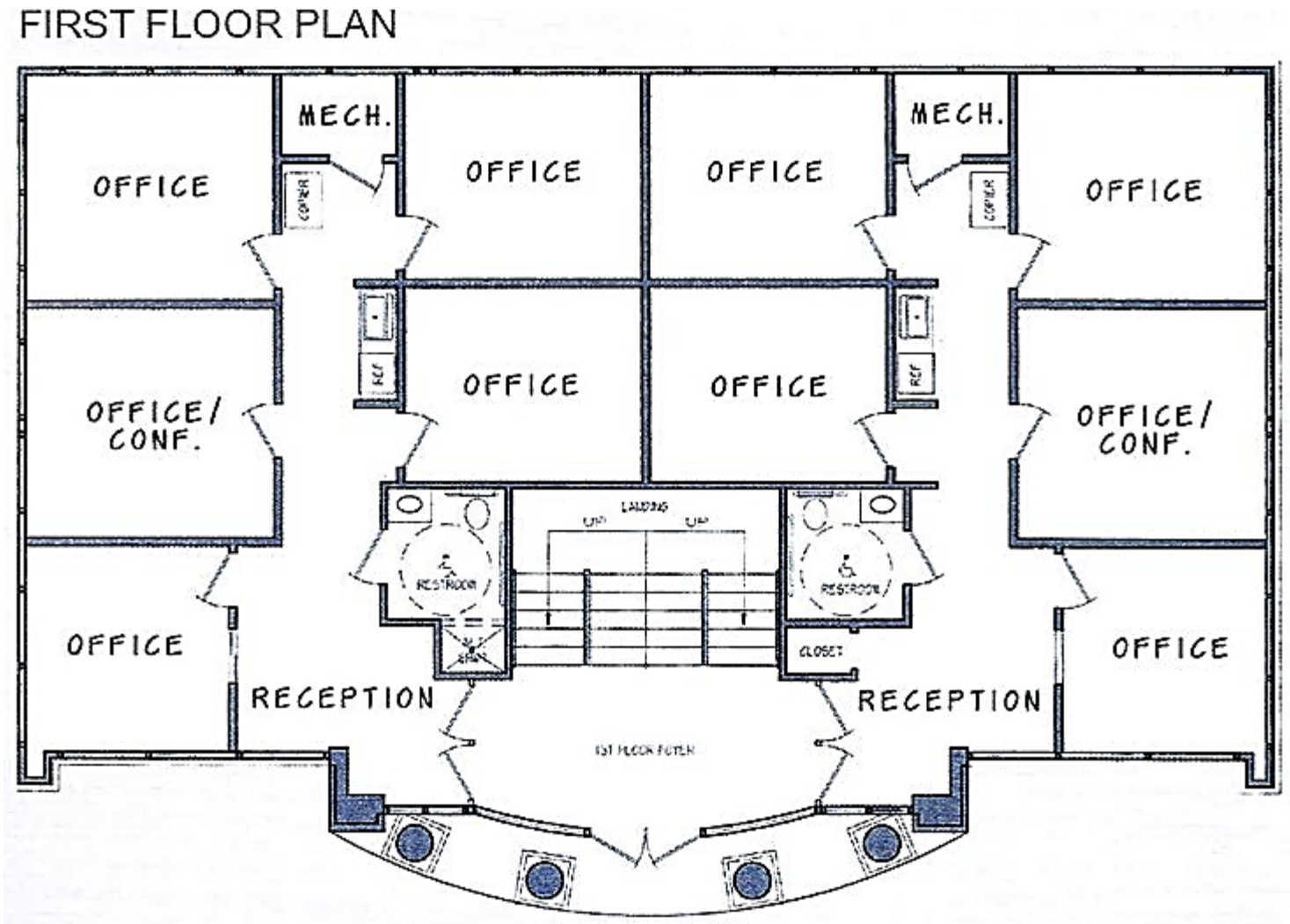
(1) During conditions of stair use, the minimum illumination for new stairs shall be at least 10 ft-candle (108 lux), measured at the walking surfaces.

(2) The minimum illumination for floors and other walking surfaces, other than new stairs during conditions of stair use, shall be to values of at least 1 ft-candle (10.8 lux), measured at the floor.

(3) In assembly occupancies, the illumination of the walking surfaces of exit access shall be at least 0.2 ft-candle (2.2 lux) during periods of performances or projections involving directed light.

(4)* The minimum illumination requirements shall not apply where operations or processes require low lighting levels.

Path of Egress?



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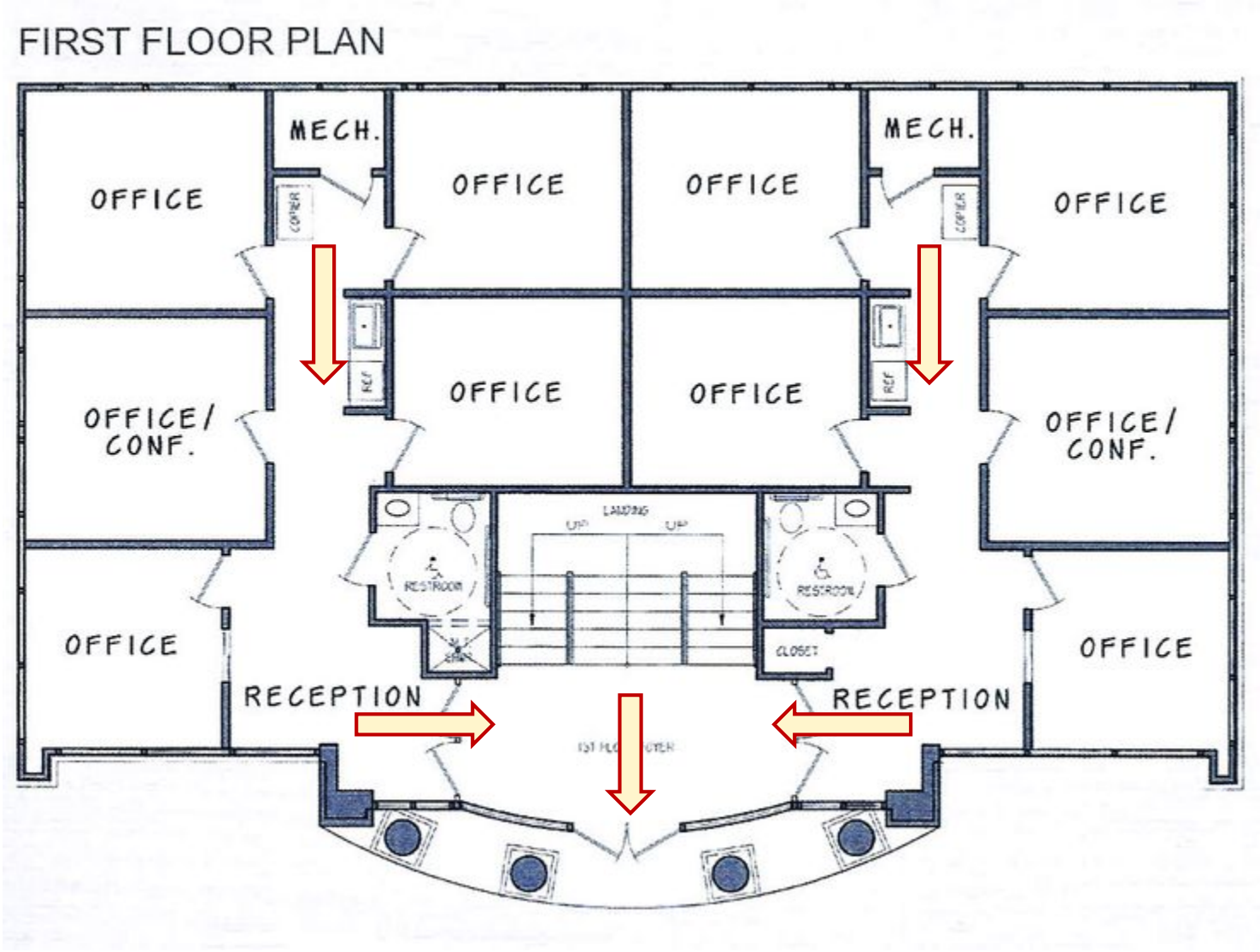
Path of Egress?



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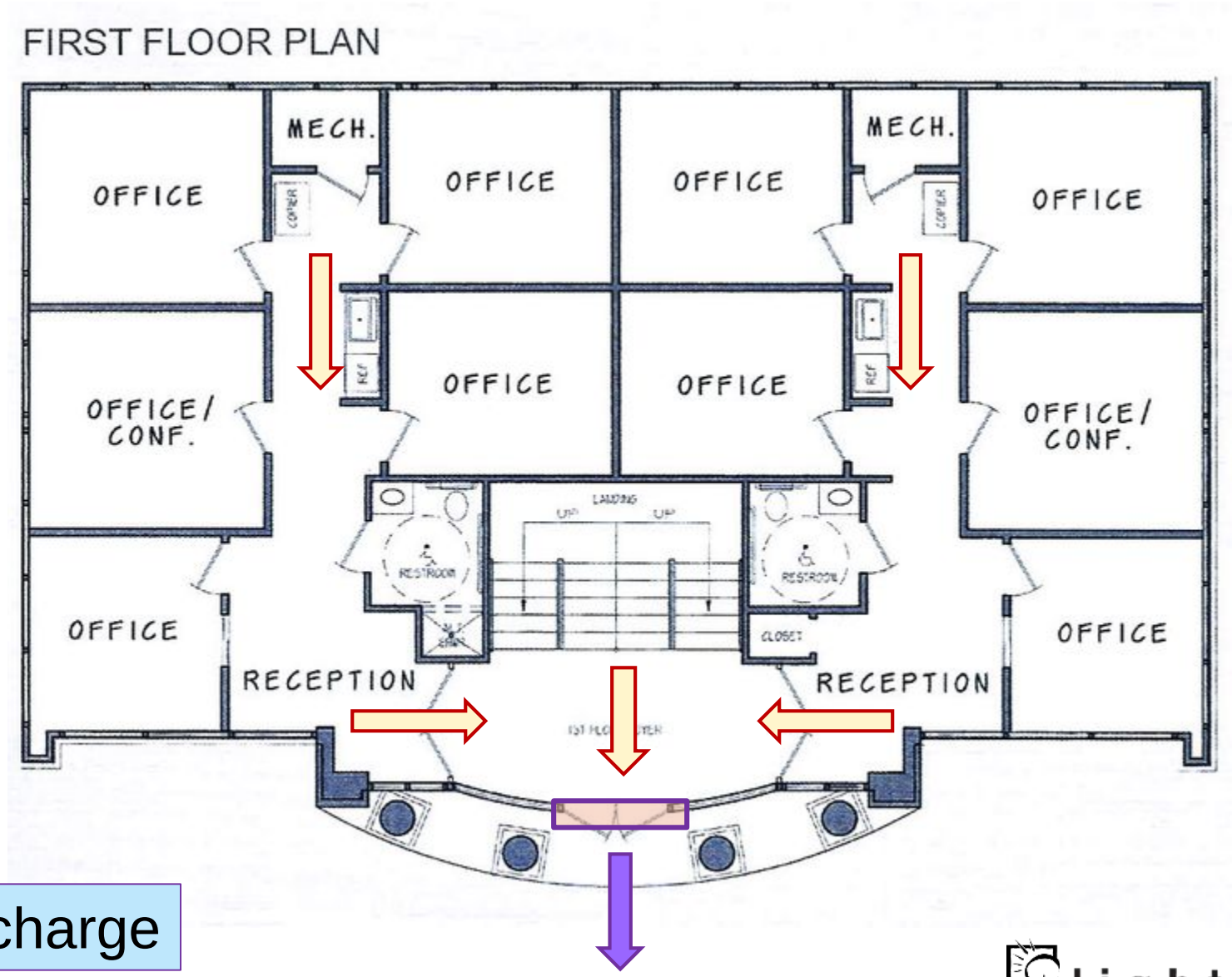
Path of Egress?



Exit Discharge

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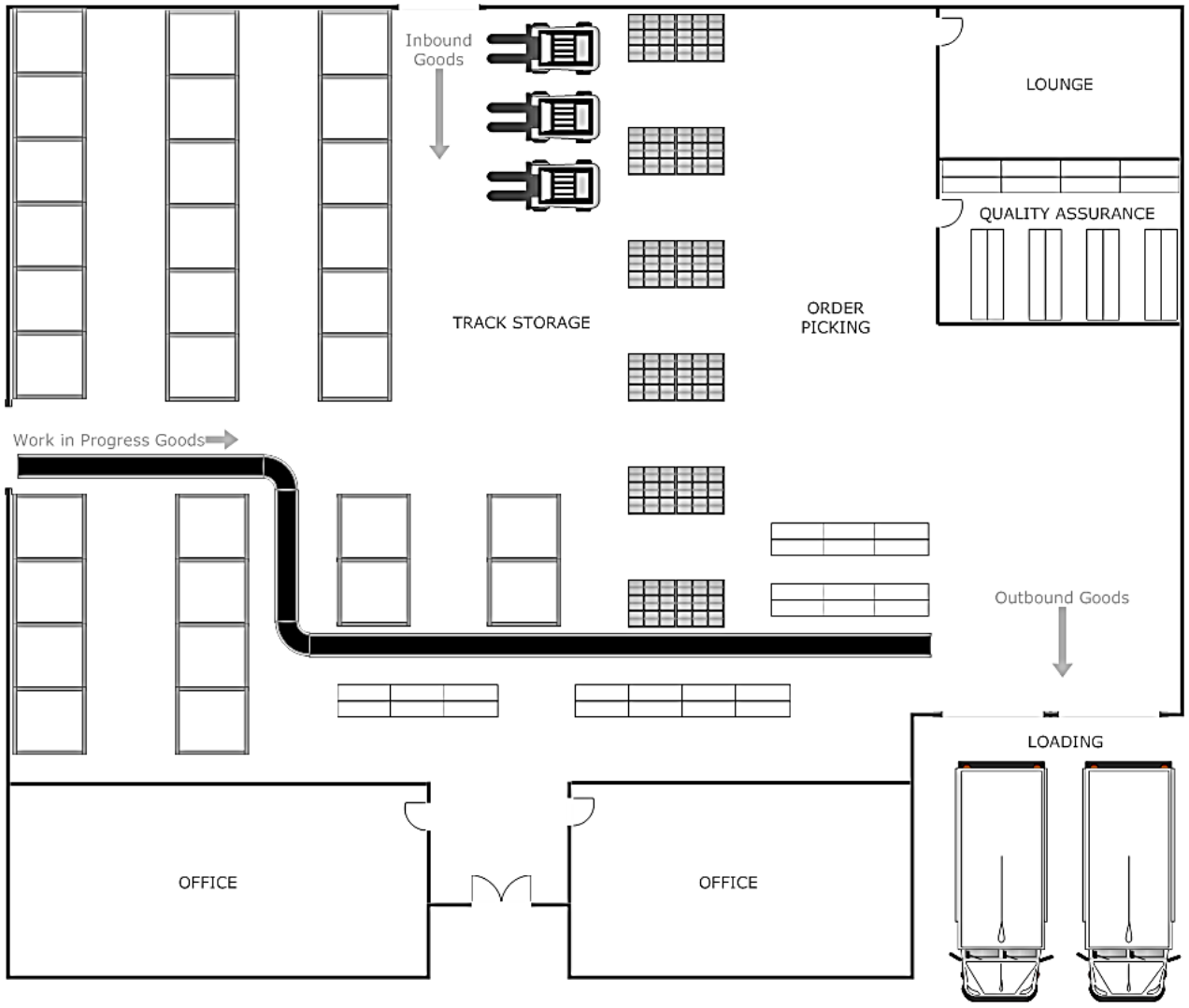
Path of Egress?



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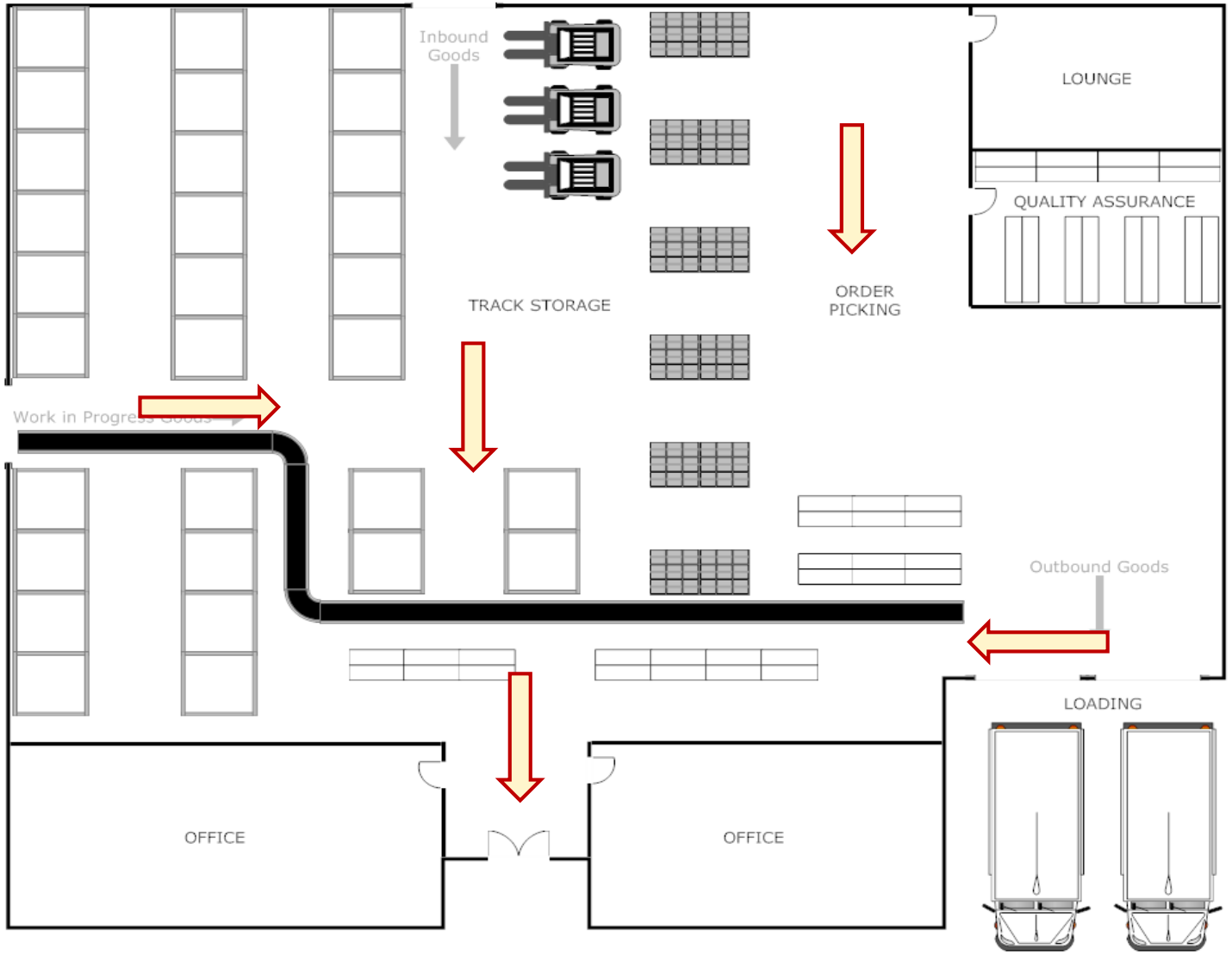
Path of Egress?



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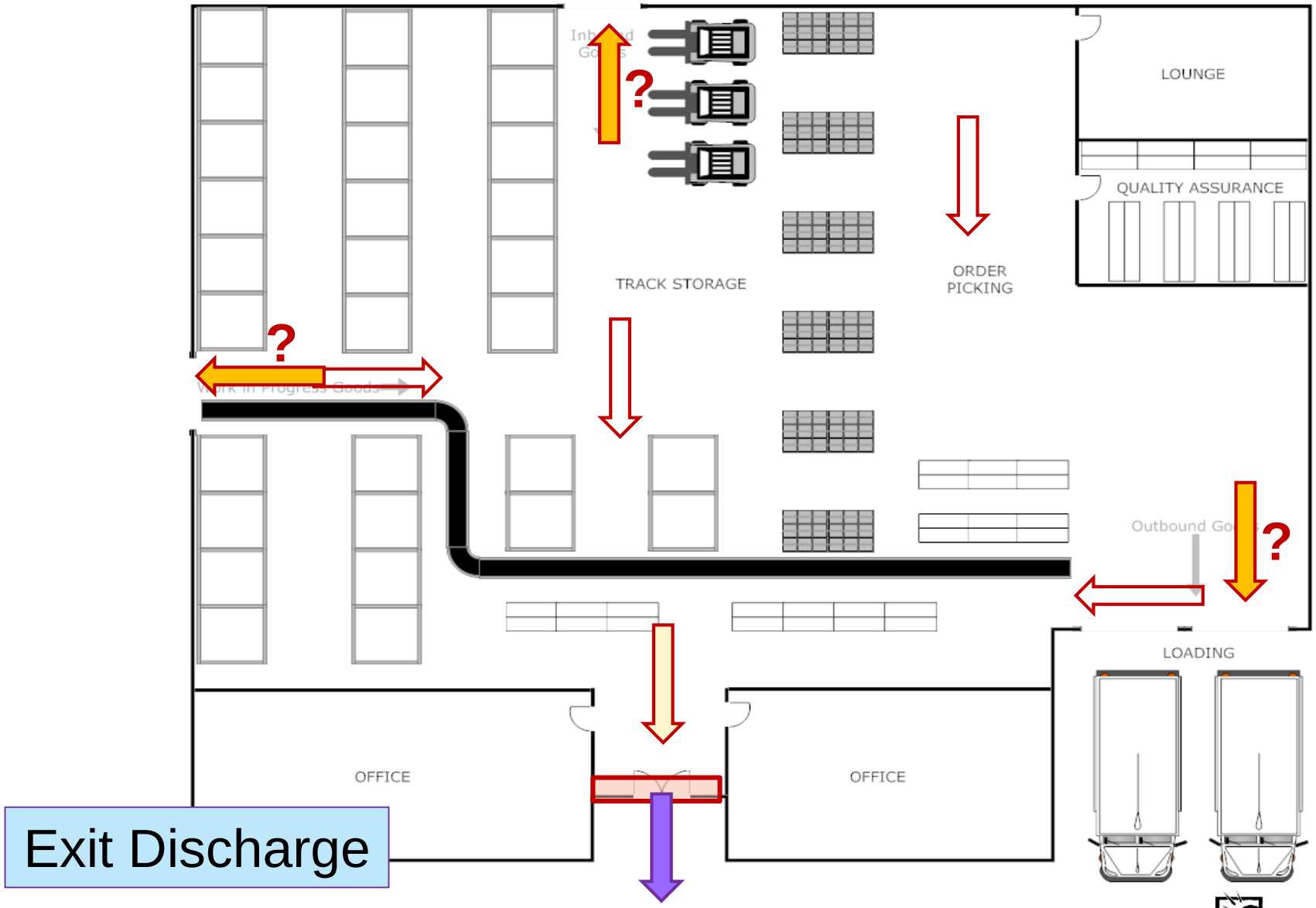

Exit Discharge

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Which edition applies?

The NFPA publishes the Life Safety Code using mandatory language that ***can*** be adopted – most often legislatively – for use in a given jurisdiction. Some U.S. government agencies adopt the Code administratively and this too has the effect of law within that agency.

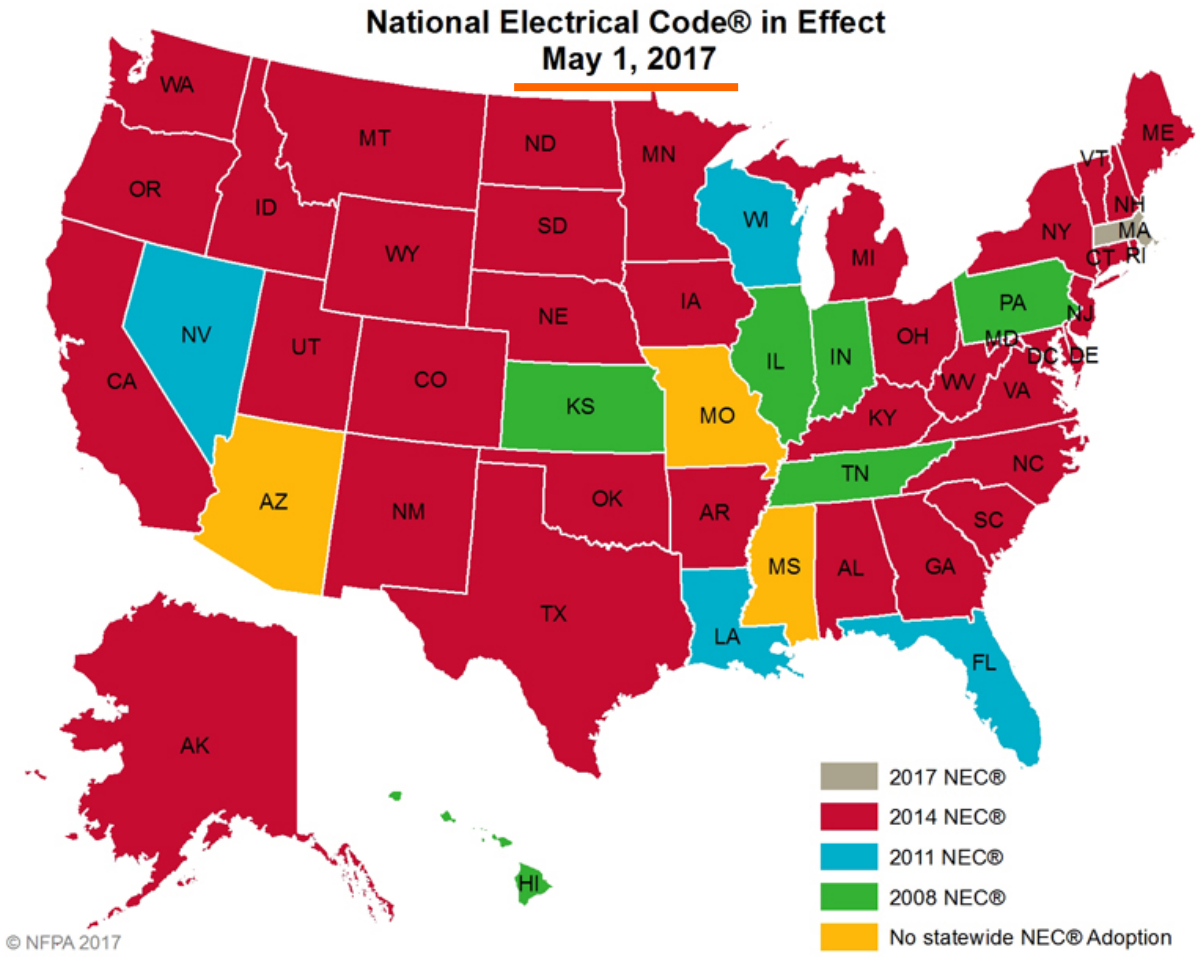
As a starting point, contact your state fire marshal to help determine if NFPA 101 Life Safety Code has been adopted for enforcement in your area. **If the Code is used, ask which edition. The Life Safety Code is published every three years. Local jurisdictions do not always adopt the most recent edition of the code.**

Visit www.nfpa.org/101 for information about current and past editions of the Life Safety Code.

Pop Quiz- The AHJ can be…?

- The person or office charged with enforcing the Life Safety Code.
- More than one source.
- Overridden by OSHA.
- An insurance inspector.
- The property owner

National Electrical Code



2017 Edition

First published in 1897, the NEC… is published by the National Fire Protection Association (NFPA), a private trade association.

Despite the use of the term "national", it is not a federal law; rather it is typically adopted by states and municipalities in an effort to standardize their enforcement of safe electrical practices. **In some cases, the NEC is amended, altered and may even be rejected in lieu of regional regulations as voted on by local governing bodies.**

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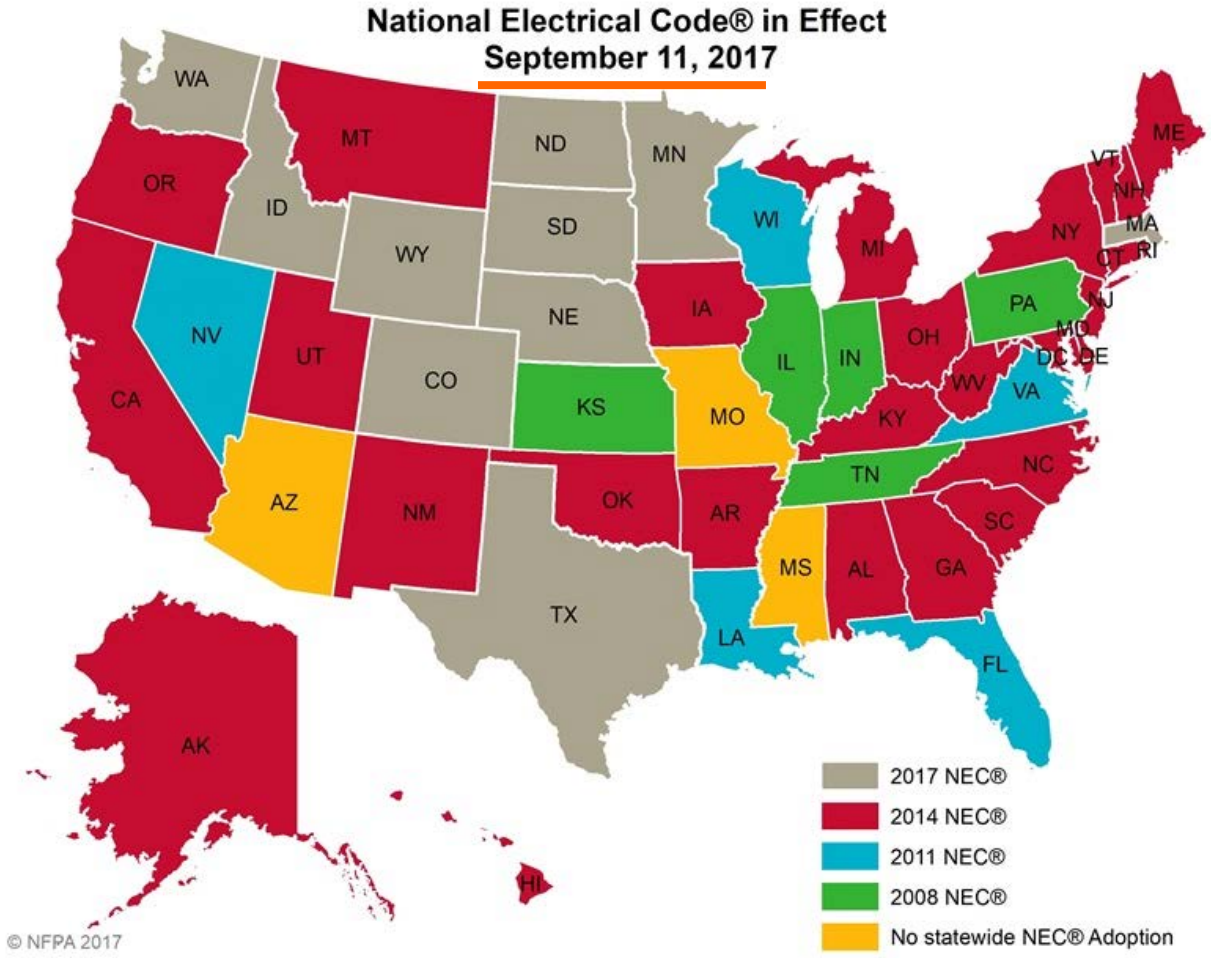
National Electrical Code



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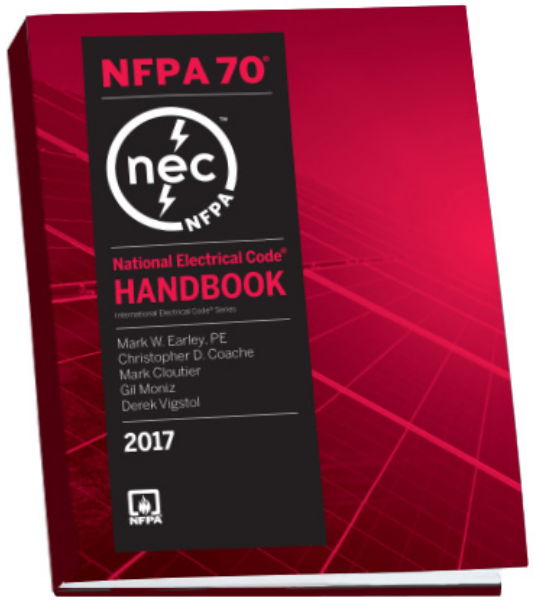
What is the purpose of the Code?

ARTICLE 90
Introduction

90.1 Purpose.

(A) Practical Safeguarding. The purpose of this *Code* is the practical safeguarding of persons and property from hazards arising from the use of electricity. This *Code* is not intended as a design specification or an instruction manual for untrained persons.

(B) Adequacy. This *Code* contains provisions that are considered necessary for safety. Compliance therewith and proper maintenance result in an installation that is essentially free from hazard but not necessarily efficient, convenient, or adequate for good service or future expansion of electrical use.



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Lighting and storage

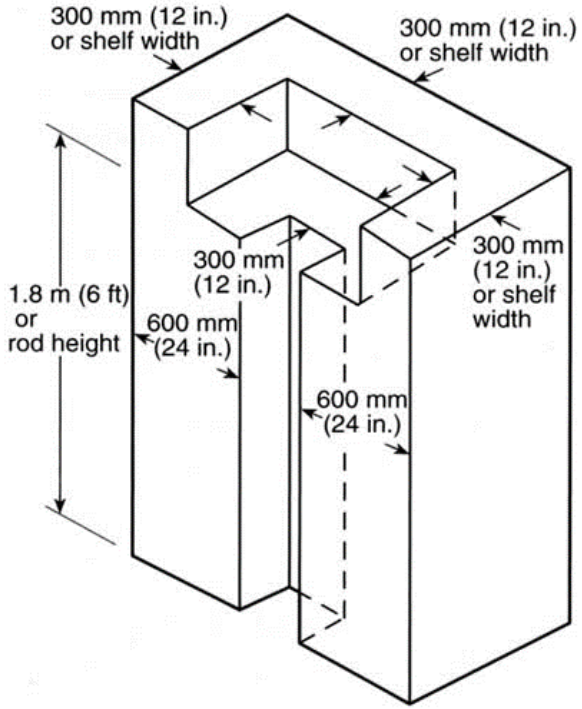
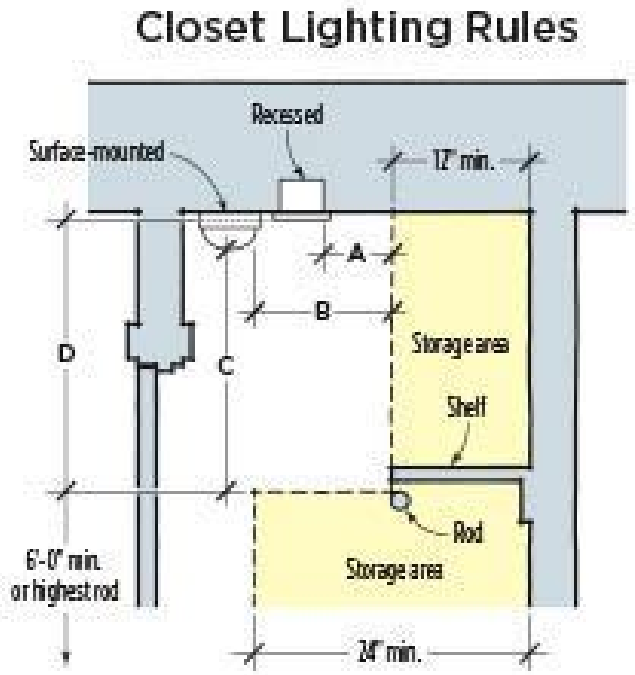


Figure 410.8 Closet storage space.



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Lighting and plumbing

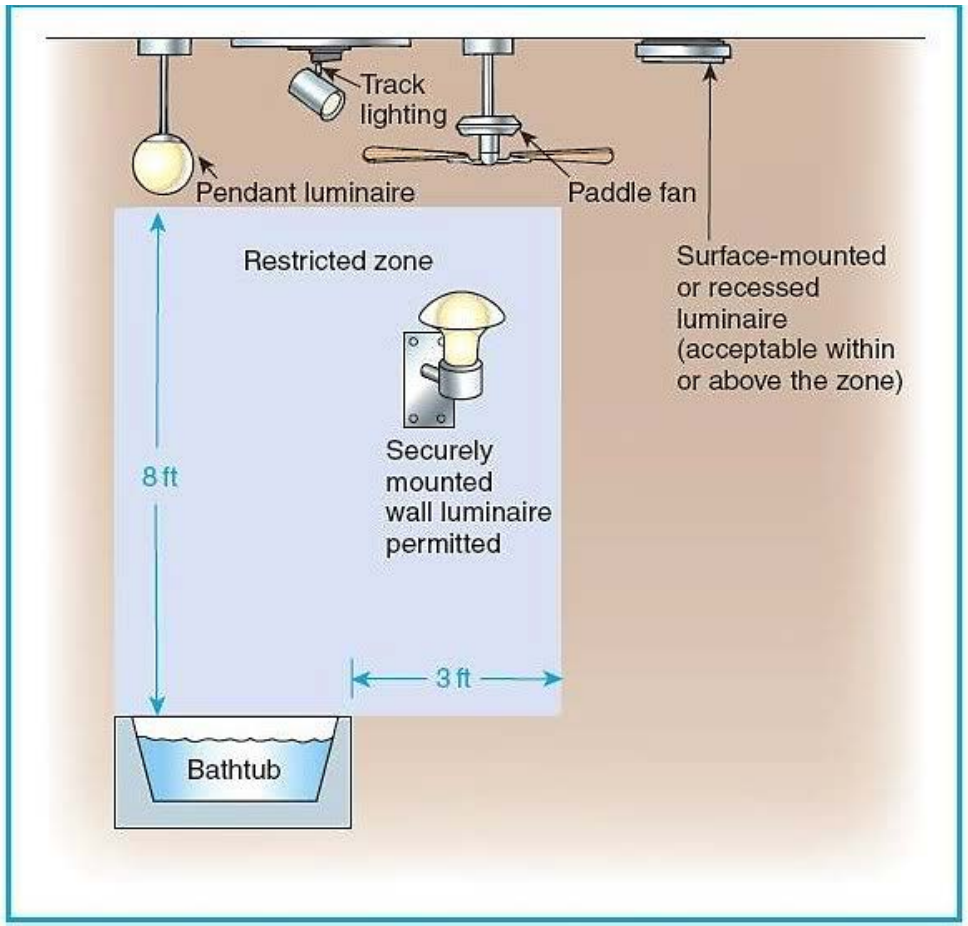

Exhibit 410.1 Luminaires, lighting track, and suspended (paddle) fan located near a bathtub.

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UNITED STATES
DEPARTMENT OF LABOR

Occupational Safety and Health Administration

Nationally Recognized Testing Laboratory Program

UL LISTED

ETL LISTED

Electrical Testing Labs

CSA

CSA tests and certifies to standards published by ANSI, UL, NSF and other leading standards publishers

Canadian Standards Association

UL and **ETL** are both what are called Nationally Recognized Testing Laboratories (NRTL). NRTLs are in place to provide independent safety and quality certifications on products. Electrical appliances typically require their certification (especially 240V appliances).

Dry Location

A dry location is an indoor area that is not normally subject to dampness. It may include a location subject to temporary dampness provided ventilation is adequate to prevent any accumulation of moisture such as in a bathroom.

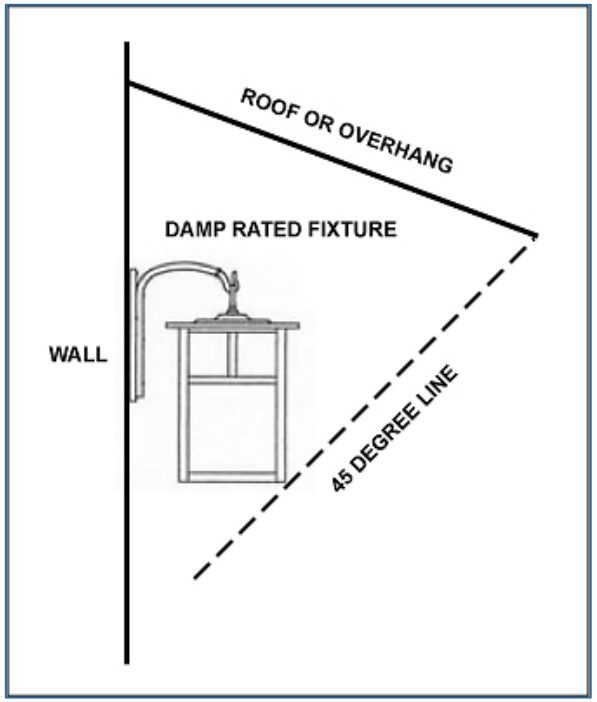
Damp Location

A damp location is typically an exterior or in some cases an interior location which is periodically subject to condensation or moisture. Damp rated light fixtures may have most of the wiring encased within the metal components of the fixture design but with a portion of the wiring exposed.

Wet Location

Light fixtures and fans indicated as "Suitable for Wet Locations" should be installed and used in a wet location (indoors or outdoors). A wet location can be an indoor or exterior location in which water or other liquids may drip, splash or flow onto the electrical components of the lighting or fan. Wet rated light fixtures will typically have all wiring encased within the metal components of the fixture design.

UL Ratings



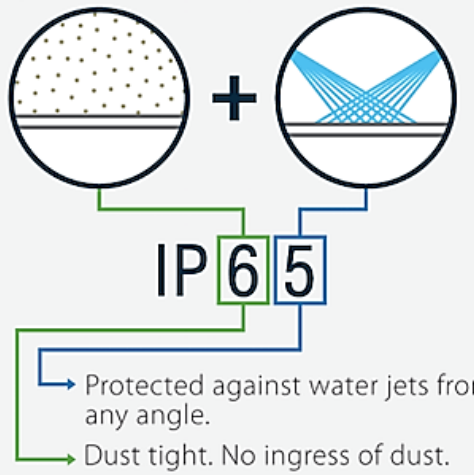
Example of an exterior Damp Location

Ingress Protections(IP) Ratings

IP Rating Chart			
First Number	**Definition**	**Second Number**	**Definition**
Protection against solid objects		*Protection against liquids*	
0	No protection	0	No protection
1	Protected against solid objects over 50mm (e.g. accidental touch by hands)	1	Protected against vertically falling drops of water
2	Protected against solid objects over 12mm (e.g. fingers)	2	Protected against direct sprays up to 15° from the vertical
3	Protected against solid objects over 2.5mm (e.g. tools and wires)	3	Protected against direct sprays up to 60° from vertical
4	Protected against solid objects over 1mm (e.g. tools, wires and small wires)	4	Protected against sprays from all directions - limited ingress permitted
5	Protected against dust - limited ingress (no harmful deposit)	5	Protected against low pressure jets if water from all directions - limited ingress permitted
6	Totally protected against dust	6	Protected against strong jets of water (e.g. for use on shipdecks - limited ingress permitted)
		7	Protected against the effects of temporary immersion between 15cm and 1m. Duration of test 30 min.
		8	Protected against long periods of immersion under pressure

The IP Rating classification method was outlined by the International Electrotechnical Commission (IEC Standard 60529), and is recognized in most countries.

Example:



IEC Compliant International Electrotechnical Commission

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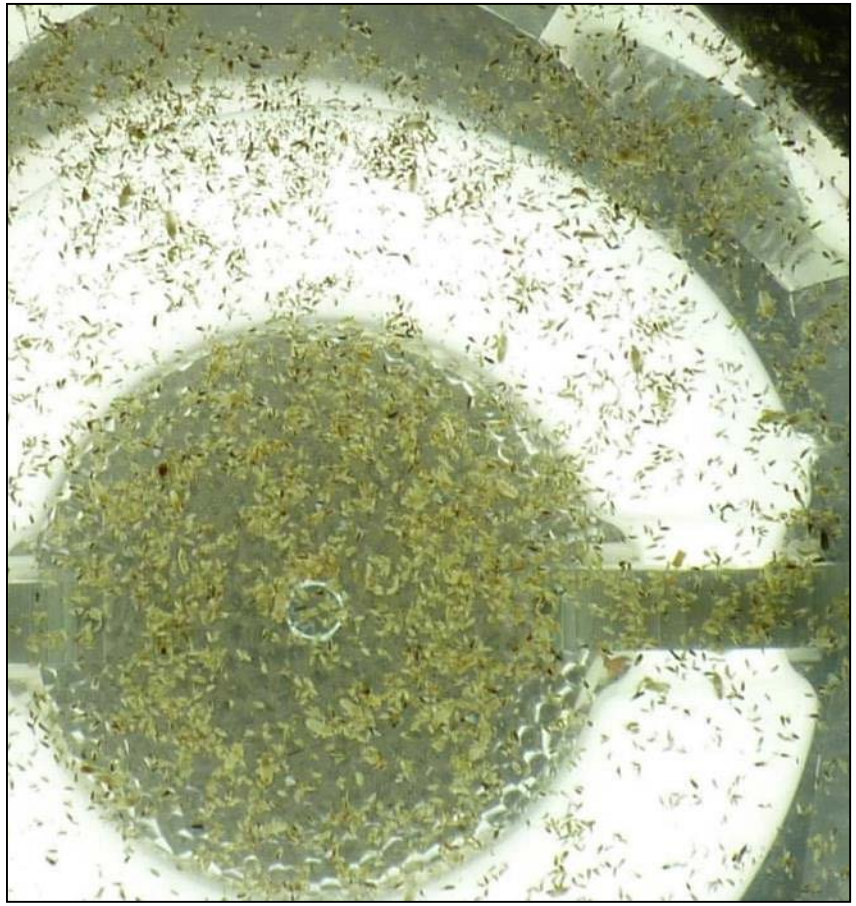
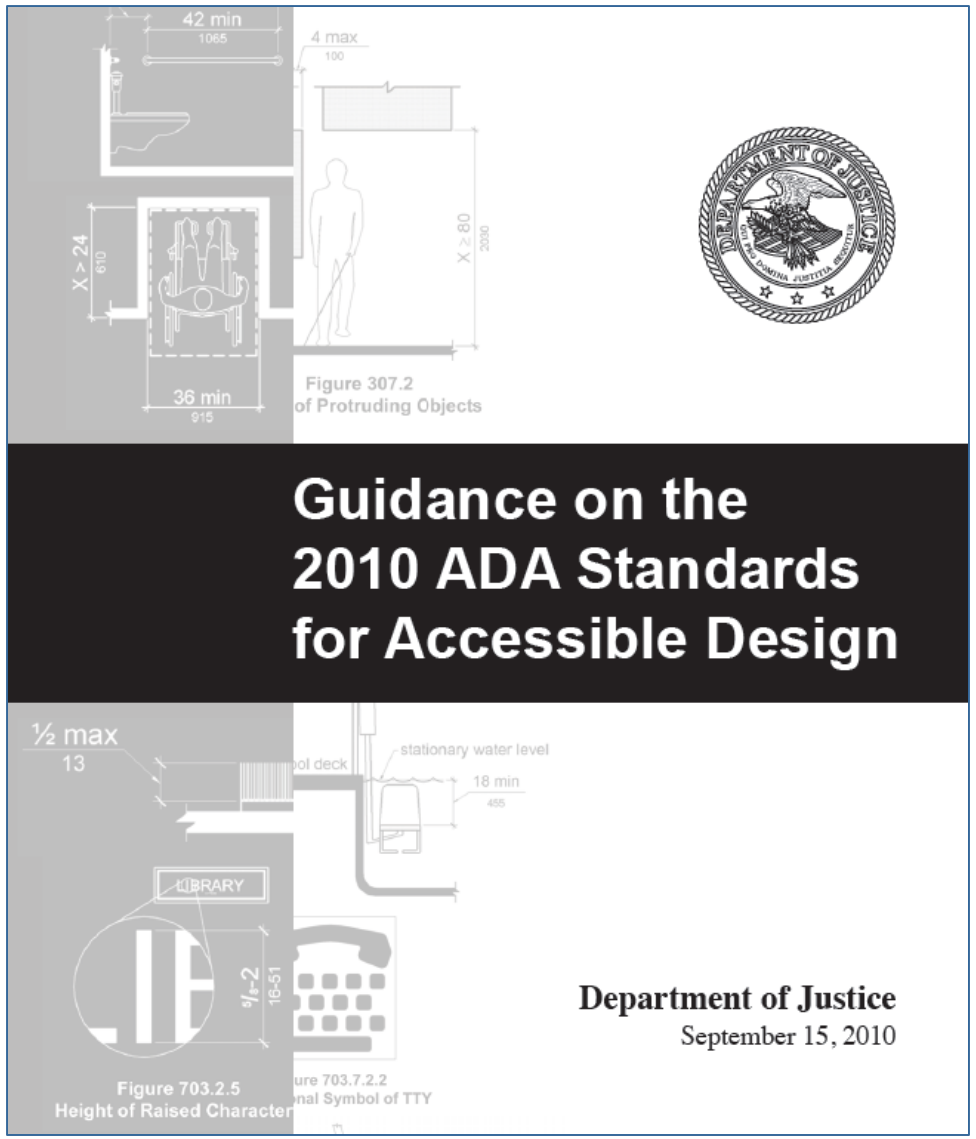
Bugs *"They check in...but they never check out."*

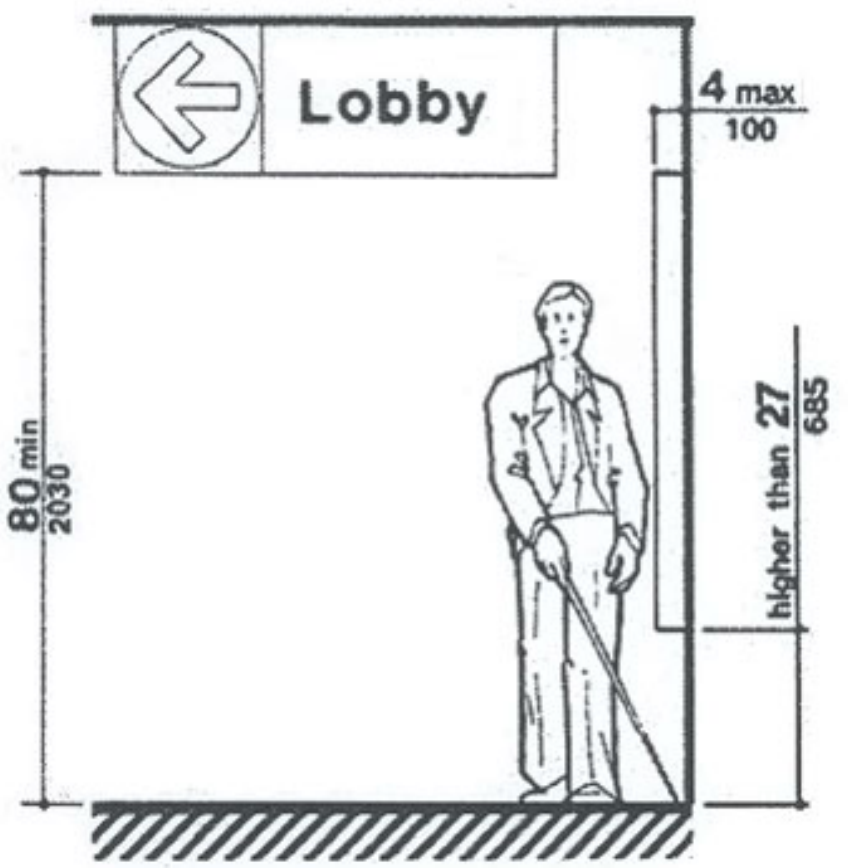


This may not be as much of a problem with higher wattage & higher temperature systems,
or with systems that don't have a lens, but do have an IP66 lamp module, like many LED fixtures.

American with Disabilities Act-



ADA.gov
United States Department of Justice
Civil Rights Division



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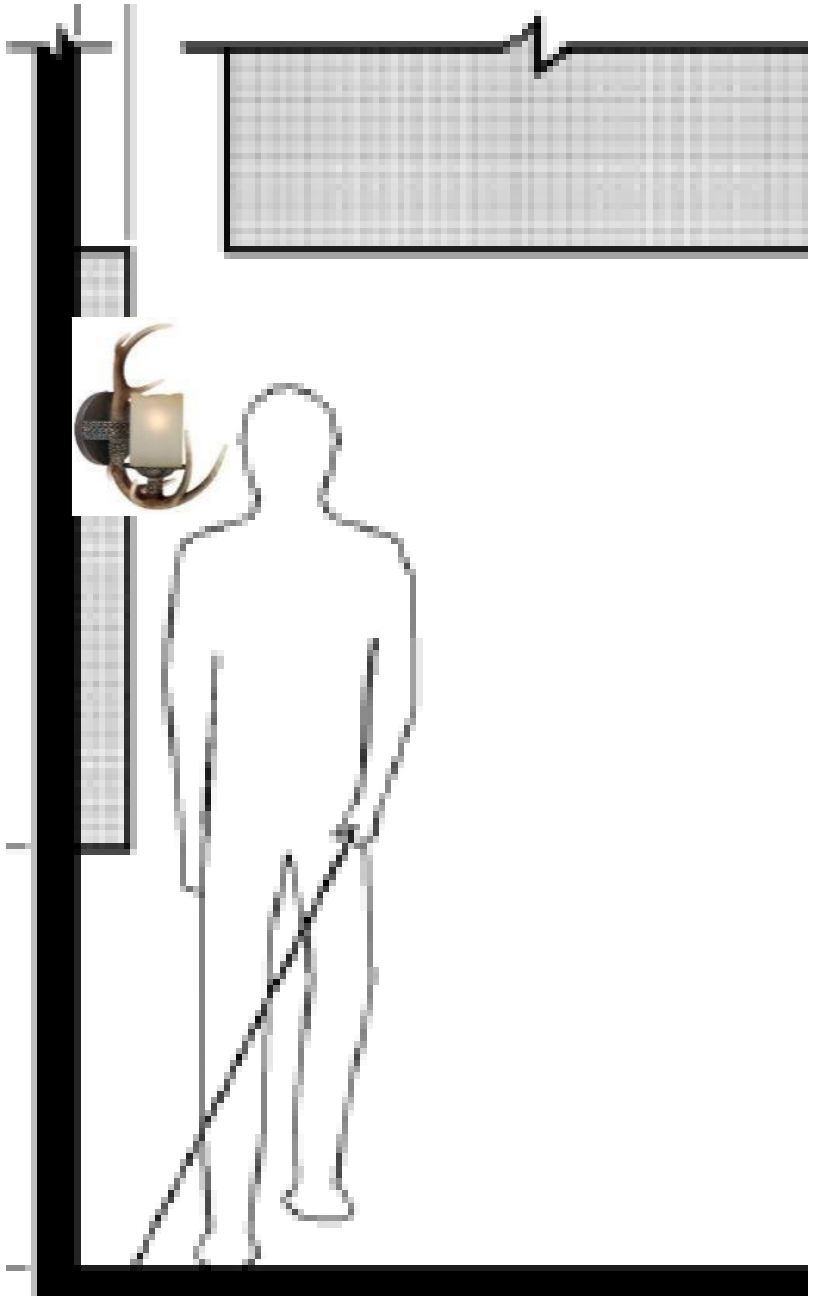

Why ADA matters

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The *International Building Code* (IBC) is the foundation of the complete Family of International Codes®. It is an essential tool to preserve public health and safety that provides safeguards from hazards associated with the built environment. *It addresses design and installation of innovative materials that meet or exceed public health and safety goals.*

ICC INTERNATIONAL CODE COUNCIL

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UNITED STATES DEPARTMENT OF LABOR

Occupational Safety and Health Administration

OSHA® Occupational Safety and Health Administration

- **Part Number:** 1926
- **Part Title:** Safety and Health Regulations for Construction
- **Subpart:** D
- **Subpart Title:** Occupational Health and Environmental Controls
- **Standard Number:** 1926.56
- **Title:** Illumination.
- **GPO Source:** e-CFR

General. Construction areas, ramps, runways, corridors, offices, shops, and storage areas shall be lighted to not less than the minimum illumination intensities listed in Table D-3 while any work is in progress:

Other areas. For areas or operations not covered above, refer to the American National Standard A11.1-1965, R1970, Practice for Industrial Lighting, for recommended values of illumination.

TABLE D-3 – MINIMUM ILLUMINATION INTENSITIES IN FOOT-CANDLES

Foot-Candles	Area of Operation
5	General construction area lighting.
3	General construction areas, concrete placement, excavation and waste areas, access ways, active storage areas, loading platforms, refueling, and field maintenance areas.
5	Indoors: warehouses, corridors, hallways, and exitways.
5	Tunnels, shafts, and general underground work areas: (Exception: minimum of 10 foot-candles is required at tunnel and shaft heading during drilling, mucking, and scaling. Bureau of Mines approved cap lights shall be acceptable for use in the tunnel heading)
10	General construction plant and shops (e.g., batch plants, screening plants, mechanical and electrical equipment rooms, carpenter shops, rigging lofts and active store rooms, mess halls, and indoor toilets and workrooms.)
30	First aid stations, infirmaries, and offices.

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UNITED STATES
DEPARTMENT OF LABOR

Occupational Safety and Health Administration

OSHA®
Occupational Safety
and Health Administration

- **Part Number:** 1917
- **Part Title:** Marine Terminals
- **Subpart:** F
- **Subpart Title:** Terminal Facilities
- **Standard Number:** 1917.123
- **Title:** Illumination.(9)
- **GPO Source:** e-CFR

..1917.123 **Illumination.**[(9)]

1917.123(a)

Working and walking areas shall be illuminated. Unless conditions described in the regulations of the United States Coast Guard (33 CFR 126.15(1) and (n), and 33 CFR 154.570) exist in the case of specific operations, *illumination in active work areas (for example, cargo transfer points) shall be of an average minimum light intensity of 5 foot-candles.* The illumination in other work areas (for example, farm areas) shall be of an average minimum light intensity of 1 foot-candle except for security purposes when a minimum light intensity of 1/2 foot-candle shall be maintained. Where occasional work tasks require more light than that which is consistently and permanently provided, supplemental lighting shall be used.

1917.123(b)

The lighting intensity shall be measured at the task/working surface in the plane in which the task/working surface is present.

1917.123(c)

Lights shall, so far as possible, be placed so that they will not shine in the eyes of employees.

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Pop Quiz- Ingress Protections Ratings define:

- Wet location.
- Protection against “dust”.
- Protection against No Protection.
- Protection against Solid Objects.
- Duration of Immersion.

State of Washington

Office of Superintendent of Public Instruction

OSPI

Home | Certification | Offices & Programs | Learning & Teaching | Assessment | Finance & iGrants

School Facilities

High-Performance School Buildings Program

State-funded school construction projects greater than 5,000 square feet are required by Chapter 39.35 RCW – High Performance Public Buildings to incorporate high-performance features into their school design and construction. School districts can use either Washington Sustainable Schools Protocol (WSSP) or Leadership in Energy and Environmental Design (LEED). WSSP is modeled after the Collaborative for High Performance Schools (CHPS) green building protocol and adapted to reflect characteristics that optimize high performance in Washington schools. WSSP is a self-certifying standard developed to help school districts comply with the goals of the law. It is a planning tool that allows designers to plan a high-performance school while considering the regional, district, and site-specific possibilities and constraints for each project. The categories in the protocol include those related to Site, Water, Materials, Energy, Indoor Environmental Quality, and Planning and Operations.

Electric Lighting Quality

Purpose: Provide an artificial lighting environment that promotes effective learning, teaching, and occupant health. K–12 classrooms must be adaptable to support a wide variety of educational media and learning activities.

IEQ2.1: Electric Lighting Quality

Required	School spaces will be designed so end of lamp life conditions meet the minimum average illumination levels as identified in WAC 246-366-120. Contrast should be minimized with a focus on uniformity in classroom spaces. Brightness and glare should be minimized to ensure a comfortable learning environment. Luminaires will be used with a luminance less than 2,500 cd/ m^2 between 45° and 90° from nadir, excluding whiteboard wall wash luminaires. Luminaires within 10 feet of the teaching wall will be separately switched from the other general luminaires for AV mode. Luminaires (with or without specific luminaires aimed at the whiteboards) will provide an average illumination of 15 footcandles on the whiteboards with an average:minimum uniformity less than 3:1. Lamp sources will have a minimum CRI/ CQS of 80. The lighting systems should operate in general illumination mode and AV mode. In **general illumination** mode, achieve an average illumination at the working plane complying with WAC 246-366-120 with a minimum of 20 footcandles (for general instructional spaces) and 35 footcandles (for special instructional spaces) at any point more than 3 feet from any wall. In AV mode, achieve an average illumination at the working plane of 33% to 66% of the general illumination footcandle level for any point in the room greater than 3 feet from the side walls, 10 feet from the front wall, and 6 feet from the back wall. Limit vertical illumination on the projection screen to no more than 7 footcandles at any point on the screen. The lighting system should be designed with flexibility in mind and allow the users to fully control the lighting level within the space.
1 point	After meeting all requirements above, dim all luminaires in the classrooms, excluding whiteboard luminaires. Provide switches that allow for manual dimming below the levels set by the photocells based on natural lighting entering the space.
1 point	After meeting all requirements above, provide a lighting system that is designed to change the color of the luminaires (approximately 3,000 K – 5,000 K) based on the respective color of the sunlight throughout the day. (Systems may be called tunable white, circadian rhythm, human-centric lighting, etc.) System may have the ability to have a temporary override (up to 60 minutes) for "calm" (3,000 K) and/ or "test" (5,000 K) settings.

Extra points

Washington Sustainable Schools Protocol

Criteria for High-Performance Schools

2015 Edition

Designing Schools for Student Success

WASHINGTON COLLABORATIVE FOR HIGH PERFORMANCE SCHOOLS
CHPS
Better buildings. Better students.

lighting design lab

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	Lamp sources will have a minimum [illegible] operate in general illumination [illegible]
	In **general illumination** mode, a[illegible] plane complying with WAC 246-[illegible] general instructional spaces) an[illegible] spaces) at any point more than [illegible]
	In AV mode, achieve an average illumination at the working plane of 33% to 66% of the general illumination footcandle level for any point in the room greater than 3 feet from the side walls, 10 feet from the front wall, and 6 feet from the back wall. Limit vertical illumination on the projection screen to no more than 7 footcandles at any point on the screen.
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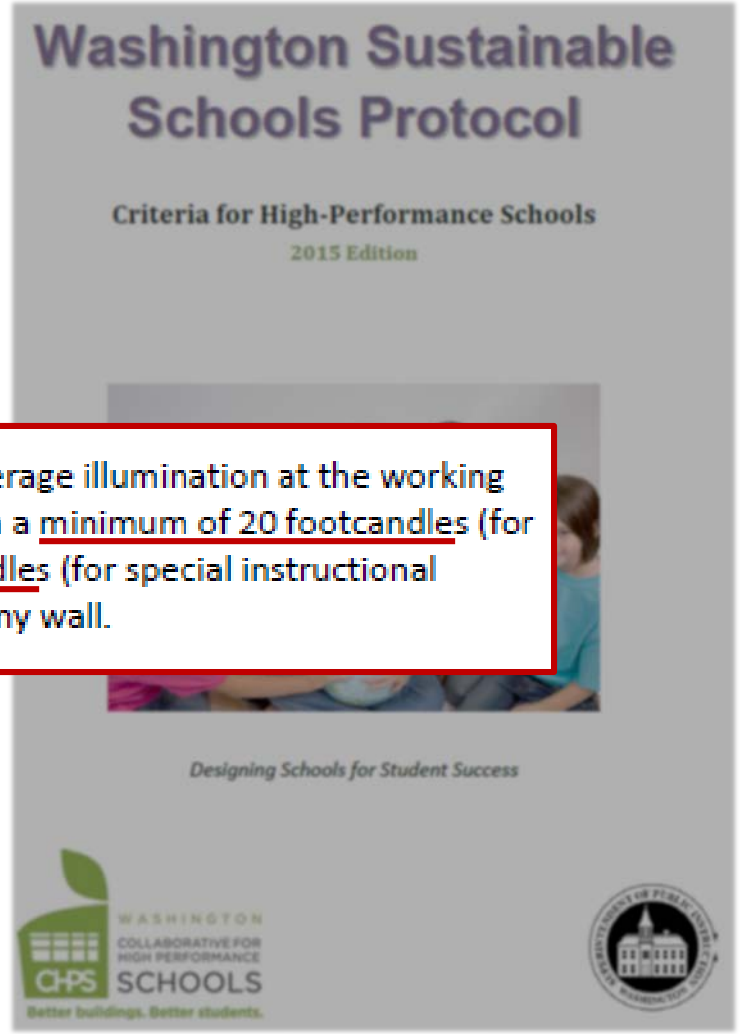

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Legislature Home

WACs

Washington Administrative Code

Regulations of executive branch agencies are issued by authority of statutes. Like legislation and the Constitution, regulations are a source of primary law in Washington State. The WAC codifies the regulations and arranges them by subject or agency. The online version of the WAC is updated twice a month. Copies of the WAC as they existed each year since 2004 are available in the WAC archive.

There's a lot of them

WACs By Title

Title 1	Code Reviser, Office of the
Title 3	Academic Achievement and Accountability Commission
Title 4	Accountancy, Board of
Title 10	Administrative Hearings, Office of
Title 12	Transportation, Department of (Aeronautics Commission)
Title 14	Advanced Tuition Payment, Committee on
Title 16	Agriculture, Department of (See Titles 24 , 60 , and 142)
Title 18	Air Pollution (See Titles 173 , 371 , and 372)
Title 24	Apple Commission
Title 25	Archaeology and Historic Preservation, Department of
Title 30	Arts Commission
Title 34	Asian Pacific American Affairs, Commission on
Title 36	Licensing, Department of (Professional Athletics)
Title 491	Volunteer Firefighters and Reserve Officers, State Board for
Title 495A	Bates Technical College
Title 495B	Bellingham Technical College
Title 495C	Clover Park Technical College
Title 495D	Lake Washington Institute of Technology
Title 495E	Renton Technical College
Title 504	Washington State University
Title 508	Ecology, Department of (Water Resources) (See Titles 173 , 197
Title 516	Western Washington University

WA Administrative Code WAC

Title 388 Social and Health Services, Department of

388-78A Assisted living facility licensing rules

WAC 388-78A-2980

Lighting.

(1) The assisted living facility must maintain electric light fixtures and lighting necessary for the comfort and safety of residents and for the activities of residents and staff.

(2) The assisted living facility must provide enough lighting in each resident's room to meet the resident's needs, preferences and choices.

(3) New assisted living facility construction must, at a minimum, **meet the Illuminating Engineering Society of North America (IESNA) recommendations** for lighting in common areas as established in the IESNA lighting handbook. The applicable handbook is the edition in effect on the date a construction review fee is paid to the department of health, construction review services, for new assisted living facility construction.

(4) Existing assisted living facility construction must maintain, at a minimum, the Illuminating Engineering Society of North America (IESNA) recommendations …that portion of the assisted living facility that underwent construction review.

WA Administrative Code WAC

Title 170 WAC EARLY LEARNING, DEPARTMENT OF

170-300 FOUNDATIONAL QUALITY STANDARDS FOR EARLY LEARNING PROGRAMS

WAC 170-300-0291 Infant and toddler safe sleep practices

(e) **Sufficiently lighting the room** in which an infant or toddler is sleeping to observe skin color;

lighting design lab

WASHINGTON STATE LEGISLATURE

Legislature Home

WACs > Title 246 > Chapter 246-366 > Section 246-366-120

Schools

Lighting.

1) The following maintained light intensities shall be provided as measured 30" above the floor or on working or teaching surfaces. General, task and/or natural lighting may be used to maintain the minimum lighting intensities.

2) Excessive Brightness and glare shall be controlled in all instruction areas. Surface contrasts and direct or indirect glare shall not cause excessive eye accommodation or eye strain problems.

3) Lighting shall be provided in a manner which minimizes shadows and other lighting deficiencies on work and teaching surfaces.

	Minimum Foot - Candle Intensity
General instructional areas including: Study halls, lecture rooms and libraries.	30
Special instructional areas where safety is of prime consideration or fine detail work is done including: Sewing rooms, laboratories (includes chemical storage areas), shops, drafting rooms and art and craft rooms.	50
Kitchen areas including: Food storage and preparation rooms.	30
Noninstructional areas including: Auditoriums, lunch rooms, assembly rooms, corridors, stairs, storerooms, and toilet rooms.	10
Gymnasiums: Main and auxiliary spaces, shower rooms and locker rooms.	20

WASHINGTON STATE LEGISLATURE

Legislature Home

WACs > Title 246 > Chapter 246-366 > Section 246-366-120

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Gymnasiums: Main and auxiliary spaces, shower rooms and locker rooms.	20

In **general illumination** mode, achieve an average illumination at the working plane complying with WAC 246-366-120 with a minimum of 20 footcandles (for general instructional spaces) and 35 footcandles (for special instructional spaces) at any point more than 3 feet from any wall. WSSP

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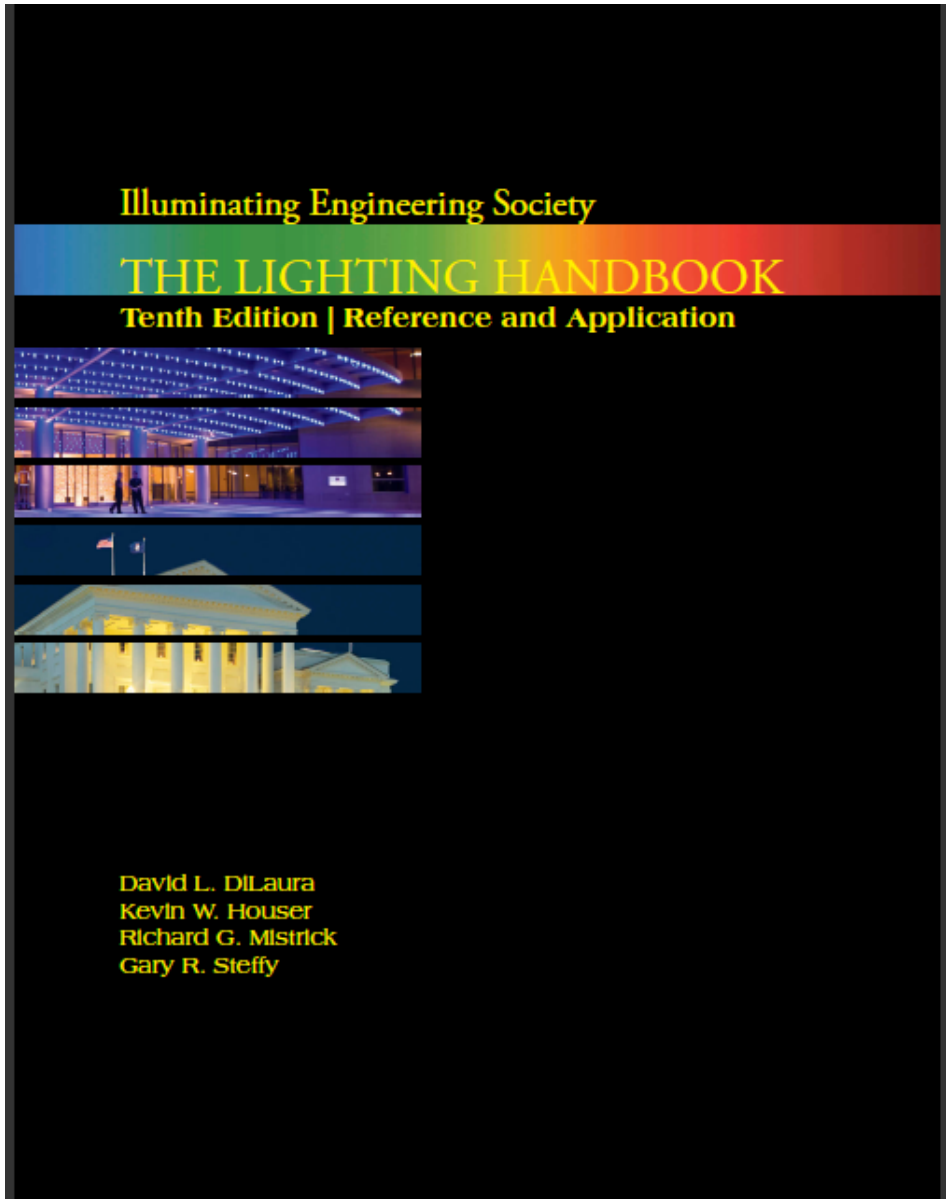
Light level recommendations circa-2012-10th Ed.



Illuminating ENGINEERING SOCIETY

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Light level recommendations
10th Ed., circa-2012 – Reading Detail

Table 32.2 | Office Facilities Illuminance Recommendations continued from previous page

Applications and Tasks[a]	Notes	Recommended Maintained Illuminance Targets (lux)[b, c, d] Horizontal (E_h) Targets: Visual Ages of Observers (years) where at least half are <25	25-65	>65	Vertical (E_v) Targets: Visual Ages of Observers (years) where at least half are <25	25-65	>65
		Category / Gauge / Category / Gauge					
OFFICES	See READING AND WRITING, establish tasks and normalize to illuminance of most important task or most common task; use controls to provide illuminance variability if tasks so demand.						
PARKING	See 26 | LIGHTING FOR EXTERIORS						
PEDESTRIAN WAYS	See 26 | LIGHTING FOR EXTERIORS						
READING AND WRITING							
• Computer	See READING AND WRITING/VDT Screen and Keyboard						
• Electronic Readers							
• Electronic Ink Devices	E_h and E_v @height of device	P Avg	150	300	600	N Avg	75	150	300
• LCD or LED Devices	E_h and E_v @height of device	N Avg	75	150	300	K Avg	25	50	100
• Facsimile									
• Analog	E_h @2' 6" AFF; E_v @4' AFF[j]	R Avg	250	500	1000	M Avg	50	100	200
• Digital	E_h @2' 6" AFF; E_v @4' AFF[j]	P Avg	150	300	600	L Avg	37.5	75	150
• Handwritten Work	Based on fair-to-good penmanship/hand print on white or canary paper								
• Pencil									
• Graphite/HB	E_h @2' 6" AFF; E_v @4' AFF[j]	P Avg	150	300	600	L Avg	37.5	75	150
• Red	E_h @2' 6" AFF; E_v @4' AFF[j]	R Avg	250	500	1000	M Avg	50	100	200
• Ballpoint/Rollerpoint/Felt-tip									
• Black	E_h @2' 6" AFF; E_v @4' AFF[j]	P Avg	150	300	600	L Avg	37.5	75	150
• Red, Green, Blue	E_h @2' 6" AFF; E_v @4' AFF[j]	Q Avg	200	400	800	L Avg	37.5	75	150
• Laptop	See READING AND WRITING/VDT Screen and Keyboard								
• Microforms (Projected)		L Avg	37.5	75	150	I Avg	15	30	60
• Print Media	Digital-printing-press-generated, white paper								
• 6-pt Font									
• Matte paper and ink	E_h @2' 6" AFF; E_v @4' AFF[j]	R Avg	250	500	1000	L Avg	37.5	75	150
• Specular paper and ink	E_h @2' 6" AFF; E_v @4' AFF[j]	R Avg	250	500	1000	L Avg	37.5	75	150
• 8- and 10-pt Font									
• Matte paper and ink	E_h @2' 6" AFF; E_v @4' AFF[j]	P Avg	150	300	600	K Avg	25	50	100
• Specular paper and ink	E_h @2' 6" AFF; E_v @4' AFF[j]	P Avg	150	300	600	K Avg	25	50	100
• 12-pt Font									
• Matte paper and ink	E_h @2' 6" AFF; E_v @4' AFF[j]	O Avg	100	200	400	K Avg	25	50	100
• Specular paper and ink	E_h @2' 6" AFF; E_v @4' AFF[j]	O Avg	100	200	400	K Avg	25	50	100
• VDT Screen and Keyboard									

TABLE 505.5.2
INTERIOR LIGHTING POWER ALLOWANCES

LIGHTING POWER DENSITY	
Building Area Type[a]	(W/ft²)
Automotive Facility	0.9
Convention Center	1.2
Court House	1.2
Dining: Bar Lounge/Leisure	1.3
Dining: Cafeteria/Fast Food	1.4
Dining: Family	1.6
Dormitory	1.0
Exercise Center	1.0
Gymnasium	1.1
Healthcare—clinic	1.0
Hospital	1.2
Hotel	1.0
Library	1.3
Manufacturing Facility	1.3
Motel	1.0
Motion Picture Theater	1.2
Multifamily	0.7
Museum	1.1
Office	1.0
Parking Garage	0.3
Penitentiary	1.0
Performing Arts Theater	1.6
Police/Fire Station	1.0
Post Office	1.1
Religious Building	1.3
Retail[b]	1.5
School/University	1.2
Sports Arena	1.1
Town Hall	1.1
Transportation	1.0
Warehouse	0.8
Workshop	1.4

IECC- 09

Light level recommendations and power density allowance are not *directly* related.

IES- 9th Ed.

I. INTERIOR LOCATIONS AND TASKS

Very Important | Important | Somewhat important | Blank = Not important or not applicable

Design Issues	Appearance of Space and Luminaires	Color Appearance (and Color Contrast)	Daylighting Integration and Control	Direct Glare	Flicker (and Strobe)	Light Distribution on Surfaces	Light Distribution on Task Plane (Uniformity)	Luminances of Room Surfaces	Modeling of Faces or Objects	Point(s) of Interest	Reflected Glare	Shadows	Source/Task/Eye Geometry	Sparkle/Desirable Reflected Highlights	Surface Characteristics	System Control and Flexibility	Special Considerations	Notes on Special Considerations	Illuminance (Horizontal)	Category or Value (lux)	Illuminance (Vertical)	Category or Value (lux)	Notes on Illuminance - see end of section	Reference Chapter(s)
Offices (13)																								Ch. 11
Filing (see Reading)																				E		C		
General and private offices (see Reading)																								
Open plan office																								
Intensive VDT use																		(14,15)		D		B		
Open plan office																								
Intermittent VDT use																		(14,15)		E		B		
Private office																				E		B		
Libraries (see Libraries)																								
Lobbies, lounges, and reception areas																				C		A		
Mail sorting																				E		A		
Copy rooms																				C		A		

lighting design lab

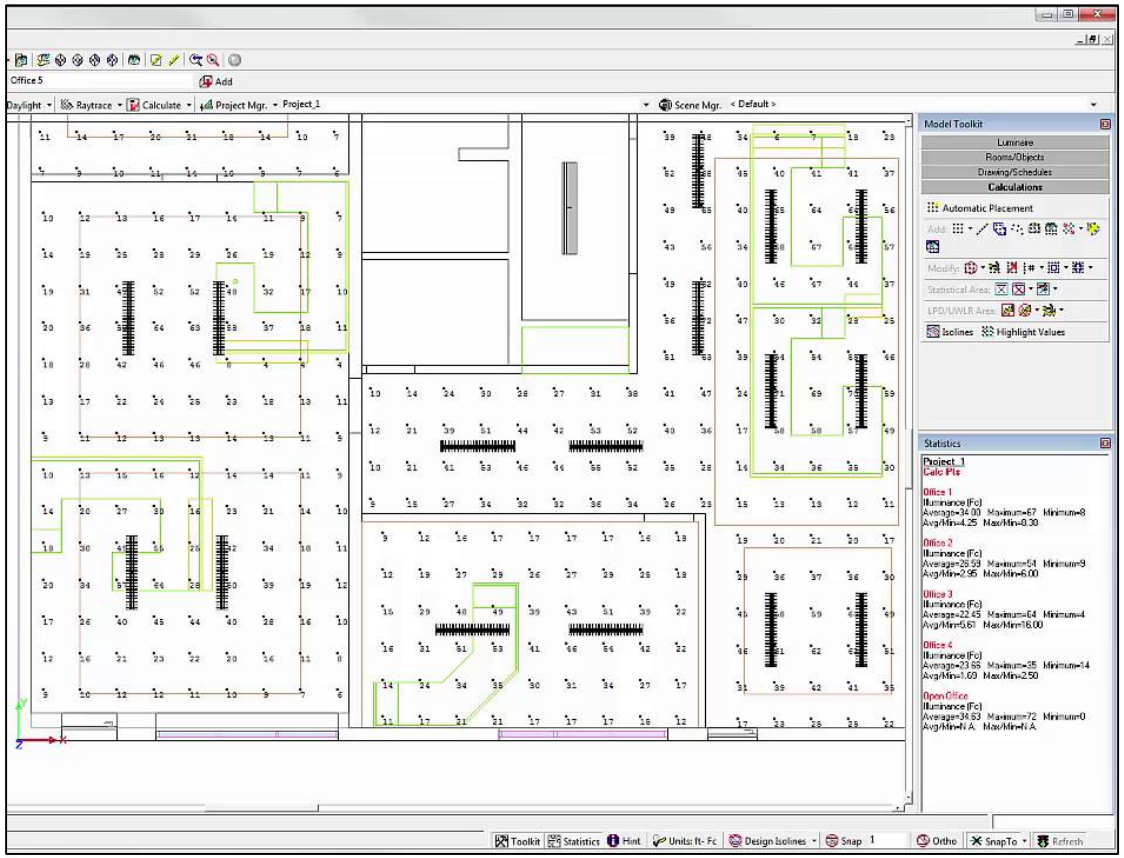
Illuminating
ENGINEERING SOCIETY

IES REQUEST FOR PROPOSAL

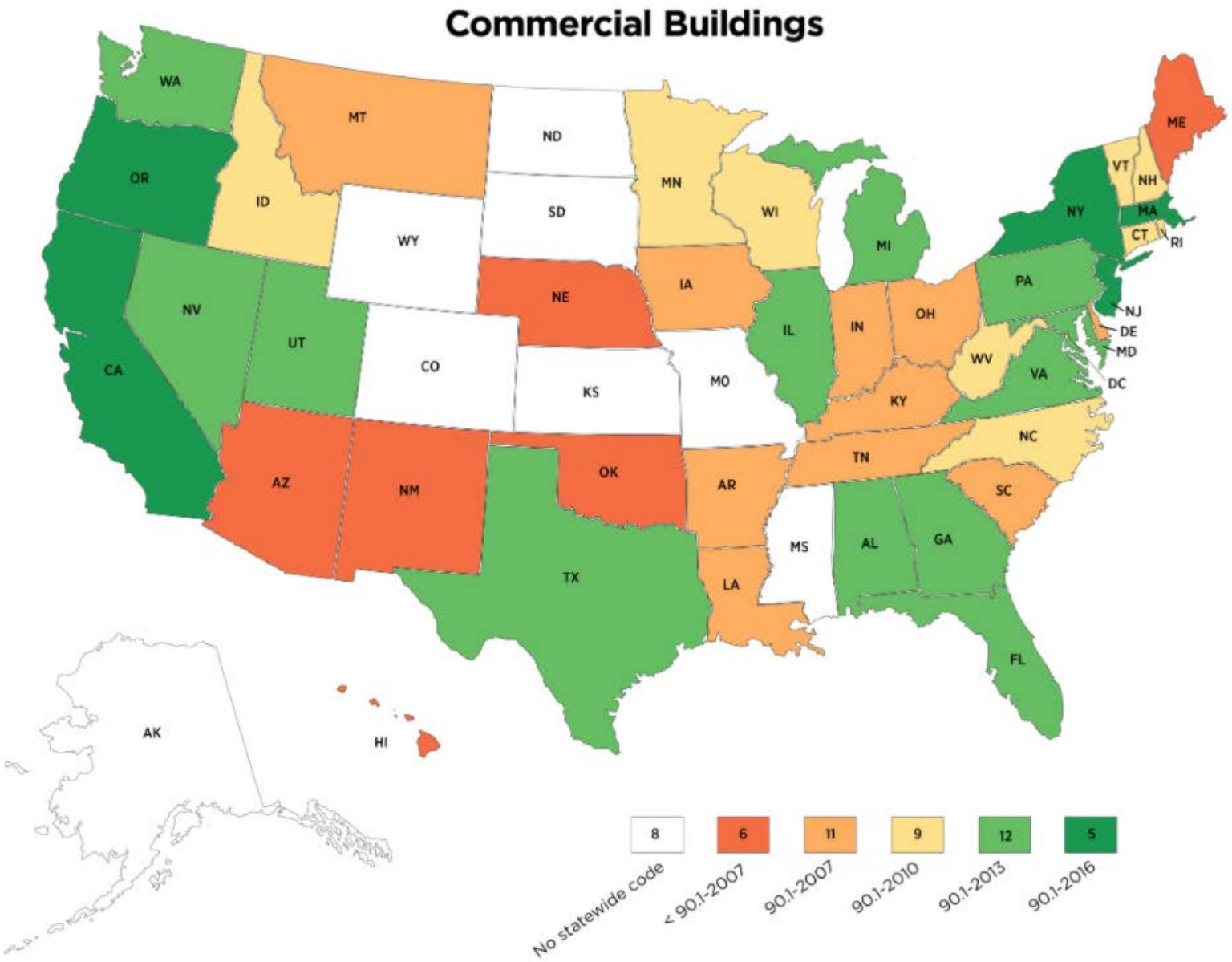
ANSI/ASHRAE/IES Standard 90.1: Lighting Computer Modeling Project

RFP Deadline: January 31, 2018

This project supports the development of the Lighting Power Density (LPD) limits in the ANSI/ASHRAE/IES 90.1 Standard that form a significant part of the basis for most of the building energy code lighting requirements across the United States. Project tasks will support the work of the 90.1 Lighting Subcommittee (LSC) by providing computer modeling that parallels the current Excel models used in Lighting Power Density (LPD) development. Computer modeling will help improve the accuracy and applicability of the LPD values which in turn will strengthen the effectiveness of the Standard and other nationally applied energy codes and standards.



lighting design lab



US Energy Code profile

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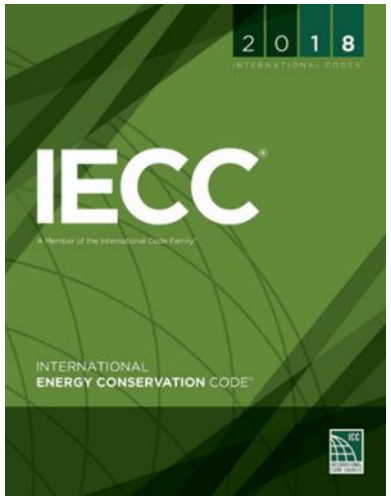
U.S. DEPARTMENT OF ENERGY | Energy Efficiency & Renewable Energy

Building Energy Codes Program

ASHRAE®



… “be aware that codes are adopted at the state, county, or city level and these entities may make modifications or amendments to the IECC and/or ASHRAE Standard 90.1.”

It is also important to know if different codes are in force for different building types, including residential, commercial, state, or federal. If it is necessary to look up which code is in effect, there are a number of resources available, including BECP’s Status of State Codes Database, the International Code Council’s (ICC) adoption database, and the Building Codes Assistance Project (BCAP) Status of Codes Database.

ICC INTERNATIONAL CODE COUNCIL®

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Code Council releases guidelines for remote virtual inspections

This publication is based on study, research and discussions from the Code Council's membership, partners and industry experts.

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Our model building codes and standards provide the highest level of safety in the world.

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Our family of solutions delivers a wide array of building safety services, including evaluation, accreditation, certification, codification, training and more.

Professional Development

We support the building industry with the latest training, mentoring and education resources.

Coronavirus Response Center

The Code Council continues to track how the global novel coronavirus (COVID-19) pandemic is affecting our

Washington

ICC

State Adoptions

The IBC, IRC, IFC, IMC, and IFGC codes are named by Washington statute and required to be adopted. The Washington State Building Code Council has authority to adopt amendments to these codes for statewide applicability.

- *2015 International Building Code*
- *2015 International Energy Conservation Code*
- *2015 International Fire Code*
- *2015 International Fuel Gas Code*
- *2015 International Mechanical Code*
- *2015 International Residential Code*
- *2015 International Wildland-Urban Code*

Links to State Adoption Agencies

Washington State Building Code Council

State Fire Marshal

Department of Commerce

Department of Labor & Industry

Department of Insurance

Department of Natural Resources

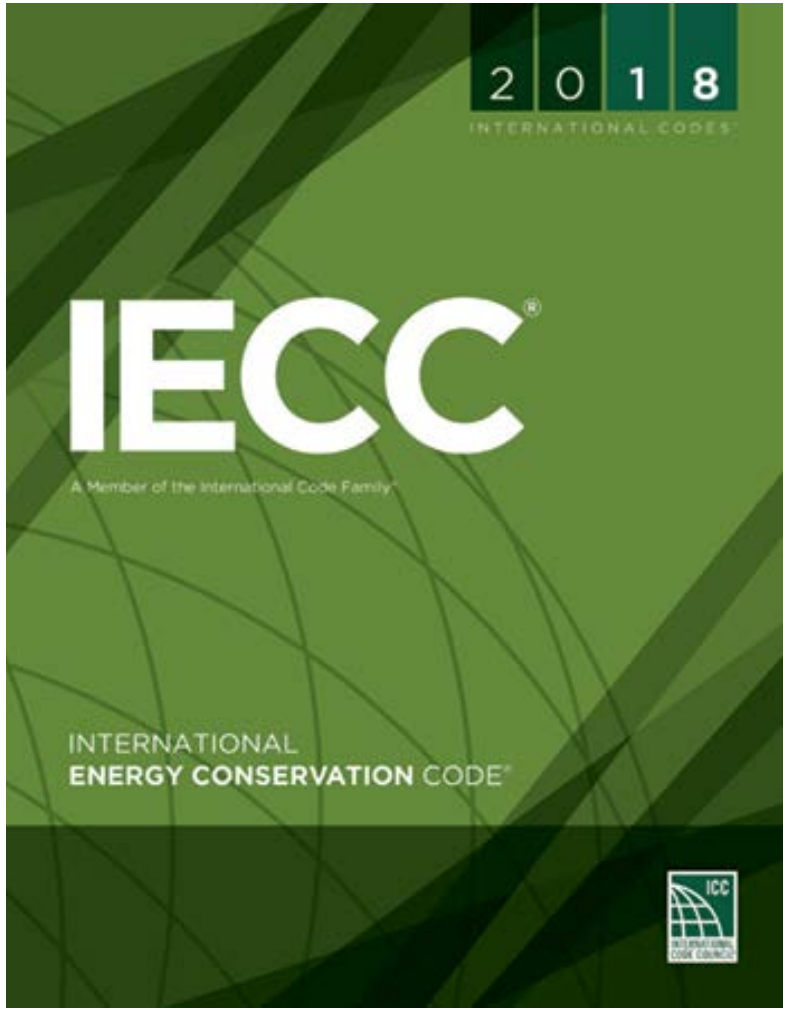
Department of Health

Key Contacts

Building Official:
WA State does not have a state building official; the SBCC has authority to adopt codes.
WA SBCC
P.O. Box 41449
Olympia, WA 98504-1449
Phone: (360) 725-2967

State Fire Marshal:
Mr. Charles LeBlanc, the SFM does not adopt state codes; the office is responsible for Fire & Life safety inspections in licensed care facilities, nursing homes,

Where does the state energy code come from?



Chapter 51-11C WAC

STATE BUILDING CODE ADOPTION AND AMENDMENT OF THE 2018 EDITION OF THE

INTERNATIONAL ENERGY CONSERVATION CODE, COMMERCIAL PROVISIONS

WASHINGTON STATE ENERGY CODE, COMMERCIAL PROVISIONS

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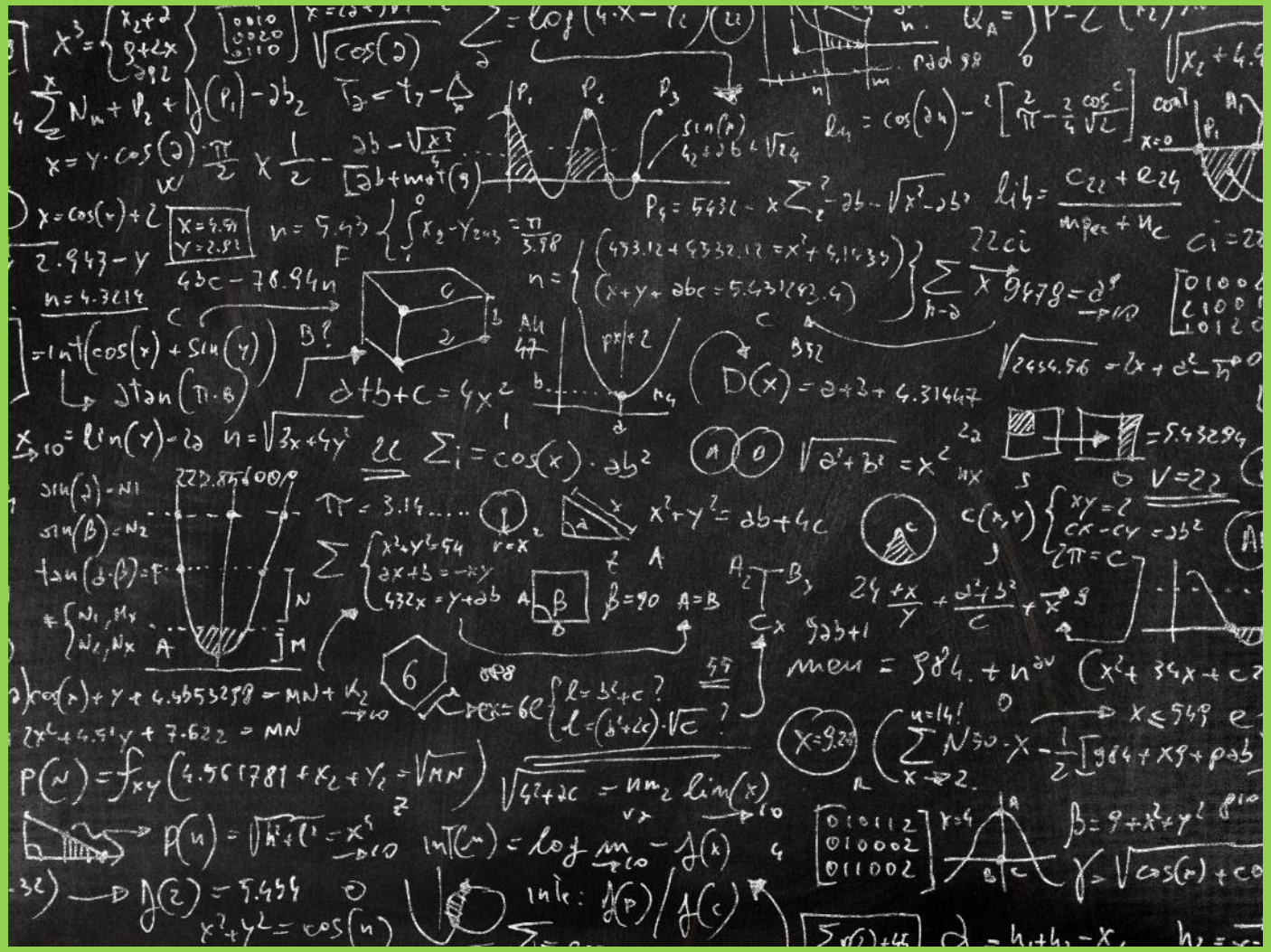
Pop Quiz- ANSI/ASHRE/IES Lighting Power Density limits are based on:

- Wishful thinking.
- Computer modeling.
- Application of standard modern lighting equipment.
- Achieving IES Lighting Recommendations.
- Available energy.



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WA State Energy Code related sections

C405.2 Lighting Controls (mandatory)

C405.4 Interior Lighting Power *Requirements*

C406 Efficiency Packages

C408 System Commissioning

Code Contents

STATE BUILDING CODE ADOPTION AND AMENDMENT OF
THE 2018 EDITION OF THE
INTERNATIONAL ENERGY CONSERVATION CODE,
COMMERCIAL PROVISIONS

WASHINGTON STATE ENERGY CODE, COMMERCIAL PROVISIONS

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CHAPTER 51-11C WAC

WASHINGTON STATE BUILDING CODE

COUNCIL EFFECTIVE JULY 1, 2020

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Chapter 1 Scope and Admin.

SECTION C101

SCOPE AND GENERAL REQUIREMENTS

Does this instill confidence?

C101.1 Title. This code shall be known as the *Washington State Energy Code*, and shall be cited as such. It is referred to herein as "this code."

C101.2 Scope. This code applies to *commercial buildings* and the buildings sites and associated systems and equipment.

C101.3 Intent. This code shall regulate the design and construction of buildings for the use and conservation of energy over the life of each building. *This code is intended to* ***provide flexibility*** *to permit the use of* ***innovative approaches*** *and techniques to achieve this objective*. This code is not intended to abridge safety, health or environmental requirements contained in other applicable codes or ordinances.

Margin Markings

▶	Indicates where a section has been deleted from the requirements of the 2015 IECC
>	Indicates 2018 IECC language deleted by Washington state amendment
▌	Indicates a change from the requirements of the 2015 IECC in the model code
‖	Indicates a Washington state amendment to the 2018 IECC (but remains unchanged from the 2015 WSEC language)
⋮	Indicates a change from the 2015 Washington state amendment
*	Indicates that text or table has been relocated within the code
**	Indicates the text or table immediately following has been relocated there from elsewhere in the code.

Chapter 1 Scope and Admin.

SECTION C101

SCOPE AND GENERAL REQUIREMENTS

C101.1 Title. This code shall be known as the *Washington State Energy Code*, and shall be cited as such. It is referred to herein as "this code."

C101.2 Scope. This code applies to *commercial buildings* and the buildings sites and associated systems and equipment.

Exception: The provisions of this code do not apply to ***temporary growing structures*** used solely for the commercial production of horticultural plants including ornamental plants, flowers, vegetables, and fruits.

C101.3 Intent. This code shall regulate the design and construction of buildings for the use and conservation of energy over the life of each building. This code is intended to provide flexibility to permit the use of innovative approaches and techniques to achieve this objective. This code is not intended to abridge safety, health or environmental requirements contained in other applicable codes or ordinances.

Margin Markings

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⋮	Indicates a change from the 2015 Washington state amendment
*	Indicates that text or table has been relocated within the code
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You have to read the entire (relevant), documentation(s).

C101.4 Applicability. Where, in any specific case, different sections of this code specify different materials, methods of construction or other requirements, ***the most restrictive shall govern***. Where there is a conflict between a general requirement and a specific requirement, the specific requirement shall govern.

SECTION C106 REFERENCED STANDARDS

C106.1 Referenced codes and standards. The codes and standards referenced in this code shall be those listed in Chapter 5*, and such codes and standards shall be considered as part of the requirements of this code to the prescribed extent of each such reference and as further regulated in Sections C106.1.1 and C106.1.2.

C106.1.1 Conflicts. Where differences occur between provisions of this code and referenced codes and standards, the provisions of this code shall apply.

C106.1.2 Provisions in referenced codes and standards. Where the extent of the reference to a referenced code or standard includes subject matter that is within the scope of this code, the provisions of this code, as applicable, shall take precedence over the provisions in the referenced code or standard.

*Actually it's Chapter 6…?

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This chapter lists the standards that are referenced in various sections of this document. The standards are listed herein by the promulgating agency of the standard, the standard identification, the effective date and title, and the section or sections of this document that reference the standard. The application of the referenced standards shall be as specified in Section 106.

AAMA

American Architectural Manufacturers Association
1827 Walden Office Square
Suite 550
Schaumburg, IL 60173-4268

Standard reference number	Title	Referenced in code section number
AAMA/WDMA/CSA 101/I.S.2/A C440—11	North American Fenestration Standard/ Specifications for Windows, Doors and Unit Skylights	Table C402.4.3

AHAM

Association of Home Appliance Manufacturers
1111 19th Street, NW, Suite 402
Washington, DC 20036

Standard reference number	Title	Referenced in code section number
ANSI/ AHAM RAC-1—2008	Room Air Conditioners	Table C403.2.3(3)

AHRI

Air Conditioning, Heating, and Refrigeration Institute
4100 North Fairfax Drive
Suite 200
Arlington, VA 22203

Standard reference number	Title	Referenced in code section number
ISO/AHRI/ASHRAE 13256-1 (2011)	Water-source Heat Pumps—Testing and Rating for Performance— Part 1: Water-to-air and Brine-to-air Heat Pumps	Table C403.2.3(2)
ISO/AHRI/ASHRAE 13256-2 (2011)	Water-source Heat Pumps—Testing and Rating for Performance— Part 2: Water-to-water and Brine-to-water Heat Pumps	Table C403.2.3(2)
210/240—08	Unitary Air Conditioning and Air-source Heat Pump Equipment	Table C403.2.3(1), Table C403.2.3(2)
310/380—04	Standard for Packaged Terminal Air Conditioners and Heat Pumps	Table C403.2.3(3)
340/360—2007	Commercial and Industrial Unitary Air-conditioning and Heat Pump Equipment	Table C403.2.3(1), Table C403.2.3(2)
365—09	Commercial and Industrial Unitary Air-conditioning Condensing Units	Table C403.2.3(1), Table C403.2.3(6)
390—2011	Performance Rating of Single Package Vertical Air Conditioners and Heat Pumps	Table C403.2.3(3)
400—01	Liquid to Liquid Heat Exchangers with Addendum 2	Table C403.2.3(9)
440—08	Room Fan Coil	C403.2.8
460—05	Performance Rating Remote Mechanical Draft Air-cooled Refrigerant Condensers	Table C403.2.3(8)
550/590—03	Water Chilling Packages Using the Vapor Compression Cycle—with Addenda	C403.2.3.1, Table C403.2.3(7), Table C406.2(6)
560—00	Absorption Water Chilling and Water-heating Packages	Table C403.2.3(7)
1160—08	Performance Rating of Heat Pump Pool Heaters	Table C404.2

AMCA

Air Movement and Control Association International
30 West University Drive
Arlington Heights, IL 60004-1806

Standard reference number	Title	Referenced in code section number
203-12	Energy Efficiency Classification for Fans	C403.2.11.3
220-08 (R2012)	Laboratory Methods of Testing Air Curtain Units	C402.5.6
500D—10	Laboratory Methods for Testing Dampers for Rating	C402.4.5.1, C402.4.5.2

ANSI

American National Standards Institute
25 West 43rd Street
Fourth Floor
New York, NY 10036

Standard reference number	Title	Referenced in code section number
Z21.10.3/CSA 4.3—11	Gas Water Heaters, Volume III—Storage Water Heaters with Input Ratings Above 75,000 Btu per Hour, Circulating Tank and Instantaneous	Table C404.2
Z21.47/CSA 2.3—12	Gas-fired Central Furnaces	Table C403.2.3(4), Table C406.2(4)
Z83.8/CSA 2.6—09	Gas Unit Heaters, Gas Packaged Heaters, Gas Utility Heaters and Gas-fired Duct Furnaces	Table C403.2.3(4), Table C406.2(4)

APSP

The Association of Pool and Spa Professionals
2111 Eisenhower Avenue
Alexandria, VA 22314

Standard reference number	Title	Referenced in code section number
14-11	American National Standard for Portable Electric Spa Efficiency	C404.8

ASHRAE

American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc.
1791 Tullie Circle, NE
Atlanta, GA 30329-2305

Standard reference number	Title	Referenced in code section number
ANSI/ASHRAE/ACCA Standard 127-2007	Method of Testing for Rating Computer and Data Processing Room Unitary Air Conditioners	C403.4.1
Standard 183—2007	Peak Cooling and Heating Load Calculations in Buildings, Except Low-rise Residential Buildings	C403.2.1
ASHRAE—2012	ASHRAE HVAC Systems and Equipment Handbook—2004	C403.2.1
ISO/AHRI/ASHRAE 13256-1 (2011)	Water-source Heat Pumps—Testing and Rating for Performance— Part 1: Water-to-air and Brine-to-air Heat Pumps	Table C403.2.3(2)
ISO/AHRI/ASHRAE 13256-2 (2011)	Water-source Heat Pumps—Testing and Rating for Performance— Part 2: Water-to-water and Brine-to-water Heat Pumps	Table C403.2.3(2)
90.1—2013	Energy Standard for Buildings Except Low-rise Residential Buildings	C401.2, C401.2.1, C402.1.1, Table C402.1.2, Table C402.2, Table C407.6.1
140—2011	Standard Method of Test for the Evaluation of Building Energy Analysis Computer Programs	C407.6.1
146—2011	Testing and Rating Pool Heaters	Table C404.2

ASME

American Society Mechanical Engineers
Two Park Avenue
New York, NY 10016-5990

Standard reference number	Title	Referenced in code section number
ASME A17.1/ CSA B44—2013	Safety Code for Elevators and Escalators	C405.9.2

ASTM

ASTM International
100 Barr Harbor Drive
West Conshohocken, PA 19428-2859

Standard reference number	Title	Referenced in code section number
C 90—13	Specification for Load-bearing Concrete Masonry Units	Table C402.2
C 1371—10	Standard Test Method for Determination of Emittance of Materials Near Room Temperature Using Portable Emissometers	Table C402.2.1.1
C 1549—09	Standard Test Method for Determination of Solar Reflectance Near Ambient Temperature Using A Portable Solar Reflectometer	Table C405.2.1.1
D 1003—11e1	Standard Test Method for Haze and Luminous Transmittance of Transparent Plastics	C402.3.2.2
E 283—04	Test Method for Determining the Rate of Air Leakage Through Exterior Windows, Curtain Walls and Doors Under Specified Pressure Differences Across the Specimen	Table C402.2.1.1, C402.4.1.2.2, Table C402.4.3, C402.4.4, C402.4.8
E 408—71(2008)	Test Methods for Total Normal Emittance of Surfaces Using Inspection-meter Techniques	Table C402.2.1.1
E 779—10	Standard Test Method for Determining Air Leakage Rate by Fan Pressurization	C402.4.1.2.3
E 903—96	Standard Test Method Solar Absorptance, Reflectance and Transmittance of Materials Using Integrating Spheres (Withdrawn 2005)	Table C402.3.1.1
E 1677—11	Standard Specification for an Air-retarder (AR) Material or System for Low-rise Framed Building Walls	C402.4.1.2.2
E 1918—06	Standard Test Method for Measuring Solar Reflectance of Horizontal or Low-sloped Surfaces in the Field	Table C402.2.1.1
E 1980—(2011)	Standard Practice for Calculating Solar Reflectance Index of Horizontal and Low-sloped Opaque Surfaces	Table C402.2.1.1
E 2178—13	Standard Test Method for Air Permanence of Building Materials	C402.4.1.2.1
E 2357—11	Standard Test Method for Determining Air Leakage of Air Barriers Assemblies	C404.1.2.2

CSA

Canadian Standards Association
5060 Spectrum Way
Mississauga, Ontario, Canada L4W 5N6

Standard reference number	Title	Referenced in code section number
AAMA/WDMA/CSA 101/I.S.2/A440—11	North American Fenestration Standard/Specification for Windows, Doors and Unit Skylights	Table C402.5.2
CSA B55.1—2012	Test Method for Measuring Efficiency and Pressure Loss of DWHR Units	C404.8
CSA B55.2—2012	Drain Water Heat Recovery Units	C404.8

CTI

Cooling Technology Institute
2611 FM 1960 West, Suite A-101
Houston, TX 77068

Standard reference number	Title	Referenced in code section number
ATC 105 (00)	Acceptance Test Code for Water Cooling Tower	Table C403.2.3(8)
ATC 105S—2011	Acceptance Test Code for Closed Circuit Cooling Towers	Table C403.2.3(8)
ATC 106—2011	Acceptance Test for Mechanical Draft Evaporative Vapor Condensers	Table C403.2.3(8)
STD 201—09	Standard for Certification of Water Cooling Towers Thermal Performances	Table C403.2.3(8)

DASMA

Door and Access Systems Manufacturers Association
1300 Sumner Avenue
Cleveland, OH 44115-2851

Standard reference number	Title	Referenced in code section number
105—92 (R2004)—13	Test Method for Thermal Transmittance and Air Infiltration of Garage Doors	Table C402.5.2

DOE

U.S. Department of Energy
c/o Superintendent of Documents
U.S. Government Printing Office
Washington, DC 20402-9325

Standard reference number	Title	Referenced in code section number
10 CFR, Part 430—1998	Energy Conservation Program for Consumer Products: Test Procedures and Certification and Enforcement Requirement for Plumbing Products; and Certification and Enforcement Requirements for Residential Appliances; Final Rule	Table C403.2.3(4), Table C403.2.3(5), Table C404.2, Table C406.2(4), Table C406.2(5)
10 CFR, Part 430, Subpart B, Appendix N—1998	Uniform Test Method for Measuring the Energy Consumption of Furnaces and Boilers	
10 CFR, Part 431—2004	Energy Efficiency Program for Certain Commercial and Industrial Equipment: Test Procedures and Efficiency Standards; Final Rules	Table C403.2.3(5), Table C406.2(5)
NAECA 87—(88)	National Appliance Energy Conservation Act 1987 [(Public Law 100-12 (with Amendments of 1988-P.L. 100-357)]	Tables C403.2.3(1), (2), (4)

IAPMO

International Association of Plumbing and Mechanical Officials
4755 E. Philadelphia Street
Ontario, CA 91761

Standard reference number	Title	Referenced in code section number
UPC—2015	Uniform Plumbing Code	C201.3

ICC

International Code Council, Inc
500 New Jersey Avenue, NW
6th Floor
Washington, DC 20001

Standard reference number	Title	Referenced in code section number
IBC—15	International Building Code	C201.3, C303.2, C402.4.4
IFC—12	International Fire Code	C201.3
IFGC—15	International Fuel Gas Code	C201.3
IMC—15	International Mechanical Code	C403.2.5, C403.2.5.1, C403.2.6, C403.2.7, C403.2.7.1, C403.2.7.1.1, C403.2.7.1.2, C403.2.7.1.3, C403.4.5, C408.2.2.1

IEEE

The Institute of Electrical and Electronic Engineers
Three Park Avenue
New York, NY 10016

Standard reference number	Title	Referenced in code section number
IEEE 515.1—2012	Standard for the Testing, Design, Installation and Maintenance of Electrical Resistance Trace Heating for Commercial Applications	C404.6.2

CHAPTER 6

REFERENCED STANDARDS

IESNA

Illuminating Engineering Society of North America
120 Wall Street, 17th Floor
New York, NY 10005-4001

Standard reference number	Title	Referenced in code section number
ANSI/ASHRAE/IESNA 90.1—2013	Energy Standard for Buildings Except Low-rise Residential Buildings	C401.2, C401.2.1, C402.1.1, Table C402.1.2, Table C402.2, Table C407.6.1

ISO

International Organization for Standardization
1, rue de Varembe, Case postale 56, CH-1211
Geneva, Switzerland

Standard reference number	Title	Referenced in code section number
ISO/AHRI/ASHRAE 13256-1 (2011)	Water-source Heat Pumps—Testing and Rating for Performance— Part 1: Water-to-air and Brine-to-air Heat Pumps	C403.2.3(2)
ISO/AHRI/ASHRAE 13256-2 (2011)	Water-Source Heat Pumps—Testing and Rating for Performance— Part 2: Water-to-water and Brine-to-water Heat Pumps	C403.2.3(2)

NEMA

National Electric Manufacturer's Association
1300 North 17th Street
Suite 1753
Rosslyn, VA 22209

Standard reference number	Title	Referenced in code section number
TP-1-2002	Guide for Determining Energy Efficiency for Distribution Transformers	C405.9
MG1-1993	Motors and Generators	C202

NFRC

National Fenestration Rating Council, Inc.
6305 Ivy Lane, Suite 140
Greenbelt, MD 20770

Standard reference number	Title	Referenced in code section number
100—2009	Procedure for Determining Fenestration Products U-factors—Second Edition	C303.1.2, C402.2.1
200—2009	Procedure for Determining Fenestration Product Solar Heat Gain Coefficients and Visible Transmittance at Normal Incidence—Second Edition	C303.1.3, C402
400—2009	Procedure for Determining Fenestration Product Air Leakage—Second Edition	Table C402.4.3

SMACNA

Sheet Metal and Air Conditioning Contractors National Association, Inc.
4021 Lafayette Center Drive
Chantilly, VA 20151-1209

Standard reference number	Title	Referenced in code section number
SMACNA—2012	HVAC Air Duct Leakage Test Manual	C403.2.7.1.3

UL

Underwriters Laboratories
333 Pfingsten Road
Northbrook, IL 60062-2096

Standard reference number	Title	Referenced in code section number
710—12	Exhaust Hoods for Commercial Cooking Equipment	C403.2.8
727—06	Oil-fired Central Furnaces—with Revisions through April 2010	Table C403.2.3(4), Table C406.2(4)
731—95	Oil-fired Unit Heaters—with Revisions through April 2010	Table C403.2.3(4), Table C406.2(4)
1784—01 (R2009)	Air Leakage Tests of Door Assemblies	C402.5.3

US-FTC

United States-Federal Trade Commission
600 Pennsylvania Avenue NW
Washington, DC 20580

Standard reference number	Title	Referenced in code section number
CFR Title 16 (May 31, 2005)	R-value Rule	C303.1.4

WDMA

Window and Door Manufacturers Association
1400 East Touhy Avenue, Suite 470
Des Plaines, IL 60018

Standard reference number	Title	Referenced in code section number
AAMA/WDMA/CSA 101/I.S.2/A440—11	North American Fenestration Standard/Specification for Windows, Doors and Unit Skylights	Table C402.4.3

*The Referenced Standards Chapter 6

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1827 Walden Office Square
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4100 North Fairfax Drive
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Arlington, VA 22203

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ISO/AHRI/ASHRAE 13256-2 (2011)	Water-source Heat Pumps—Testing and Rating for Performance— Part 2: Water-to-water and Brine-to-water Heat Pumps	Table C403.2.3(2)
210/240—08	Unitary Air Conditioning and Air-source Heat Pump Equipment	Table C403.2.3(1), Table C403.2.3(2)
310/380—04	Standard for Packaged Terminal Air Conditioners and Heat Pumps	Table C403.2.3(3)
340/360—2007	Commercial and Industrial Unitary Air-conditioning and Heat Pump Equipment	Table C403.2.3(1), Table C403.2.3(2)
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Air Movement and Control Association International
30 West University Drive
Arlington Heights, IL 60004-1806

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American National Standards Institute
25 West 43rd Street
Fourth Floor
New York, NY 10036

Standard reference number	Title	Referenced in code section number
Z21.10.3/CSA 4.3—11	Gas Water Heaters, Volume III—Storage Water Heaters with Input Ratings Above 75,000 Btu per Hour, Circulating Tank and Instantaneous	Table C404.2
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Z83.8/CSA 2.6—09	Gas Unit Heaters, Gas Packaged Heaters, Gas Utility Heaters and Gas-fired Duct Furnaces	Table C403.2.3(4), Table C406.2(4)

APSP

The Association of Pool and Spa Professionals
2111 Eisenhower Avenue
Alexandria, VA 22314

Standard reference number	Title	Referenced in code section number
14-11	American National Standard for Portable Electric Spa Efficiency	C404.8

ASHRAE

American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc.
1791 Tullie Circle, NE
Atlanta, GA 30329-2305

Standard reference number	Title	Referenced in code section number
ANSI/ASHRAE/ACCA Standard 127-2007	Method of Testing for Rating Computer and Data Processing Room Unitary Air Conditioners	C403.4.1
Standard 183—2007	Peak Cooling and Heating Load Calculations in Buildings, Except Low-rise Residential Buildings	C403.2.1
ASHRAE—2012	ASHRAE HVAC Systems and Equipment Handbook—2004	C403.2.1
ISO/AHRI/ASHRAE 13256-1 (2011)	Water-source Heat Pumps—Testing and Rating for Performance— Part 1: Water-to-air and Brine-to-air Heat Pumps	Table C403.2.3(2)
ISO/AHRI/ASHRAE 13256-2 (2011)	Water-source Heat Pumps—Testing and Rating for Performance— Part 2: Water-to-water and Brine-to-water Heat Pumps	Table C403.2.3(2)
90.1—2013	Energy Standard for Buildings Except Low-rise Residential Buildings	C401.2, C401.2.1, C402.1.1, Table C402.1.2, Table C402.2, Table C407.6.1
140—2011	Standard Method of Test for the Evaluation of Building Energy Analysis Computer Programs	C407.6.1
146—2011	Testing and Rating Pool Heaters	Table C404.2

ASME

American Society Mechanical Engineers
Two Park Avenue
New York, NY 10016-5990

Standard reference number	Title	Referenced in code section number
ASME A17.1/ CSA B44—2013	Safety Code for Elevators and Escalators	C405.9.2

ASTM

ASTM International
100 Barr Harbor Drive
West Conshohocken, PA 19428-2959

Standard reference number	Title	Referenced in code section number
C 90—13	Specification for Load-bearing Concrete Masonry Units	Table C402.2
C 1371—10	Standard Test Method for Determination of Emittance of Materials Near Room Temperature Using Portable Emissometers	Table C402.2.1.1
C 1549—09	Standard Test Method for Determination of Solar Reflectance Near Ambient Temperature Using A Portable Solar Reflectometer	Table C405.2.1.1
D 1003—11e1	Standard Test Method for Haze and Luminous Transmittance of Transparent Plastics	C403.3.2.2
E 283—04	Test Method for Determining the Rate of Air Leakage Through Exterior Windows, Curtain Walls and Doors Under Specified Pressure Differences Across the Specimen	Table C402.2.1.1, C402.4.1.2.2, Table C402.4.3, C402.4.4, C402.4.8
E 408—71(2008)	Test Methods for Total Normal Emittance of Surfaces Using Inspection-meter Techniques	Table C402.2.1.1
E 779—10	Standard Test Method for Determining Air Leakage Rate by Fan Pressurization	C402.4.1.2.3
E 903—96	Standard Test Method Solar Absorptance, Reflectance and Transmittance of Materials Using Integrating Spheres (Withdrawn 2005)	Table C403.2.1.1
E 1677—11	Standard Specification for an Air-retarder (AR) Material or System for Low-rise Framed Building Walls	C402.4.1.2.2
E 1918—06	Standard Test Method for Measuring Solar Reflectance of Horizontal or Low-sloped Surfaces in the Field	Table C402.2.1.1
E 1980—(2011)	Standard Practice for Calculating Solar Reflectance Index of Horizontal and Low-sloped Opaque Surfaces	Table C402.2.1.1
E 2178—13	Standard Test Method for Air Permanence of Building Materials	C402.4.1.2.1
E 2357—11	Standard Test Method for Determining Air Leakage of Air Barriers Assemblies	C404.1.2.2

CSA

Canadian Standards Association
5060 Spectrum Way
Mississauga, Ontario, Canada L4W 5N6

Standard reference number	Title	Referenced in code section number
AAMA/WDMA/CSA 101/I.S.2/A440—11	North American Fenestration Standard/Specification for Windows, Doors and Unit Skylights	Table C402.5.2
CSA B55.1—2012	Test Method for Measuring Efficiency and Pressure Loss of DWHR Units	C404.8
CSA B55.2—2012	Drain Water Heat Recovery Units	C404.8

CTI

Cooling Technology Institute
2611 FM 1960 West, Suite A-101
Houston, TX 77068

Standard reference number	Title	Referenced in code section number
ATC 105 (00)	Acceptance Test Code for Water Cooling Tower	Table C403.2.3(8)
ATC 105S—2011	Acceptance Test Code for Closed Circuit Cooling Towers	Table C403.2.3(8)
ATC 106—2011	Acceptance Test for Mechanical Draft Evaporative Vapor Condensers	Table C403.2.3(8)
STD 201—09	Standard for Certification of Water Cooling Towers Thermal Performances	Table C403.2.3(8)

DASMA

Door and Access Systems Manufacturers Association
1300 Sumner Avenue
Cleveland, OH 44115-2851

Standard reference number	Title	Referenced in code section number
105—92 (R2004)—13	Test Method for Thermal Transmittance and Air Infiltration of Garage Doors	Table C402.5.2

DOE

U.S. Department of Energy
c/o Superintendent of Documents
U.S. Government Printing Office
Washington, DC 20402-9325

Standard reference number	Title	Referenced in code section number
10 CFR, Part 430—1998	Energy Conservation Program for Consumer Products: Test Procedures and Certification and Enforcement Requirement for Plumbing Products; and Certification and Enforcement Requirements for Residential Appliances; Final Rule	Table C403.2.3(4), Table C403.2.3(5), Table C404.2, Table C406.2(4), Table C406.2(5)
10 CFR, Part 430, Subpart B, Appendix N—1998	Uniform Test Method for Measuring the Energy Consumption of Furnaces and Boilers	
10 CFR, Part 431—2004	Energy Efficiency Program for Certain Commercial and Industrial Equipment: Test Procedures and Efficiency Standards; Final Rules	Table C403.2.3(5), Table C406.2(5)
NAECA 87—(88)	National Appliance Energy Conservation Act 1987 [(Public Law 100-12 (with Amendments of 1988-P.L. 100-357)]	Tables C403.2.3(1), (2), (4)

IAPMO

International Association of Plumbing and Mechanical Officials
4755 E. Philadelphia Street
Ontario, CA 91761

Standard reference number	Title	Referenced in code section number
UPC—2015	Uniform Plumbing Code	C201.3

ICC

International Code Council, Inc
500 New Jersey Avenue, NW
6th Floor
Washington, DC 20001

Standard reference number	Title	Referenced in code section number
IBC—15	International Building Code	C201.3, C303.2, C402.4.4
IFC—15	International Fire Code	C201.3
IFGC—15	International Fuel Gas Code	C201.3
IMC—15	International Mechanical Code	C403.2.5, C403.2.5.1, C403.2.6, C403.2.7, C403.2.7.1, C403.2.7.1.1, C403.2.7.1.2, C403.2.7.1.3, C403.4.5, C408.2.2.1

IEEE

The Institute of Electrical and Electronic Engineers
Three Park Avenue
New York, NY 10016

Standard reference number	Title	Referenced in code section number
IEEE 515.1—2012	Standard for the Testing, Design, Installation and Maintenance of Electrical Resistance Trace Heating for Commercial Applications	C404.6.2

CHAPTER 6

REFERENCED STANDARDS

IESNA

Illuminating Engineering Society of North America
120 Wall Street, 17th Floor
New York, NY 10005-4001

Standard reference number	Title	Referenced in code section number
ANSI/ASHRAE/IESNA 90.1—2013	Energy Standard for Buildings Except Low-rise Residential Buildings	C401.2, C401.2.1, C402.1.1, Table C402.1.2, Table C402.2, Table C407.6.1

ISO

International Organization for Standardization
1, rue de Varembe, Case postale 56, CH-1211
Geneva, Switzerland

Standard reference number	Title	Referenced in code section number
ISO/AHRI/ASHRAE 13256-1 (2011)	Water-source Heat Pumps—Testing and Rating for Performance— Part 1: Water-to-air and Brine-to-air Heat Pumps	C403.2.3(2)
ISO/AHRI/ASHRAE 13256-2 (2011)	Water-Source Heat Pumps—Testing and Rating for Performance— Part 2: Water-to-water and Brine-to-water Heat Pumps	C403.2.3(2)

NEMA

National Electric Manufacturer's Association
1300 North 17th Street
Suite 1753
Rosslyn, VA 22209

Standard reference number	Title	Referenced in code section number
TP-1-2002	Guide for Determining Energy Efficiency for Distribution Transformers	C405.9
MG1-1993	Motors and Generators	C202

NFRC

National Fenestration Rating Council, Inc.
6305 Ivy Lane, Suite 140
Greenbelt, MD 20770

Standard reference number	Title	Referenced in code section number
100—2009	Procedure for Determining Fenestration Products U-factors—Second Edition	C303.1.2, C402.2.1
200—2009	Procedure for Determining Fenestration Product Solar Heat Gain Coefficients and Visible Transmittance at Normal Incidence—Second Edition	C303.1.3, C402
400—2009	Procedure for Determining Fenestration Product Air Leakage—Second Edition	Table C402.4.3

SMACNA

Sheet Metal and Air Conditioning Contractors National Association, Inc.
4021 Lafayette Center Drive
Chantilly, VA 20151-1209

Standard reference number	Title	Referenced in code section number
SMACNA—2012	HVAC Air Duct Leakage Test Manual	C403.2.7.1.3

UL

Underwriters Laboratories
333 Pfingsten Road
Northbrook, IL 60062-2096

Standard reference number	Title	Referenced in code section number
710—12	Exhaust Hoods for Commercial Cooking Equipment	C403.2.8
727—06	Oil-fired Central Furnaces—with Revisions through April 2010	Table C403.2.3(4), Table C406.2(4)
731—95	Oil-fired Unit Heaters—with Revisions through April 2010	Table C403.2.3(4), Table C406.2(4)
1784—01 (R2009)	Air Leakage Tests of Door Assemblies	C402.5.3

US-FTC

United States-Federal Trade Commission
600 Pennsylvania Avenue NW
Washington, DC 20580

Standard reference number	Title	Referenced in code section number
CFR Title 16 (May 31, 2005)	R-value Rule	C303.1.4

WDMA

Window and Door Manufacturers Association
1400 East Touhy Avenue, Suite 470
Des Plaines, IL 60018

Standard reference number	Title	Referenced in code section number
AAMA/WDMA/CSA 101/I.S.2/A440—11	North American Fenestration Standard/Specification for Windows, Doors and Unit Skylights	Table C402.4.3

*The Referenced Standards Chapter 6

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Chapter 2 Definitions (over 150)

- Alteration
- Approved
- Automatic
- Building Commissioning
- Certified Commissioning Pro.
- Code Official
- Commercial building

...

- Walk-In Freezer
- Wall
- Zone

Chapter 2 Definitions (over 150)

- Alteration
- Approved
- Automatic
- Building Commissioning
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- Code Official
- Commercial building

…

- Walk-In Freezer
- **Wall**
- Zone

WALL. That portion of the *building envelope*, including opaque area and *fenestration*, that is vertical or tilted at an angle of 60 degrees from horizontal or greater. This includes *above-grade walls* and *below-grade walls*, between floor spandrels, peripheral edges of floors, and foundation *walls.*

Some popular definitions.

BUILDING COMMISSIONING. A process that verifies and documents that the building systems have been installed, and function according to the approved construction documents.

DAYLIGHT RESPONSIVE CONTROL. A device or system that provides *automatic* control of electric light levels based on the amount of daylight in a space.

DWELLING UNIT. A single unit providing complete independent living facilities for one or more persons, including permanent provisions for living, sleeping, eating, cooking and sanitation.

GENERAL LIGHTING. Lighting that provides a substantially uniform level of illumination throughout an area. General lighting shall not include lighting that provides a dissimilar level of illumination to serve a specific application or decorative feature within such area.

SLEEPING UNIT. A room or space in which people sleep, which can also include permanent provisions for living, eating, and either sanitation or kitchen facilities but not both. Such rooms and spaces that are also part of a dwelling unit are not *sleeping units*.

TIME SWITCH CONTROL. An *automatic* control device or system that controls lighting or other loads, including switching off, based on time schedules.

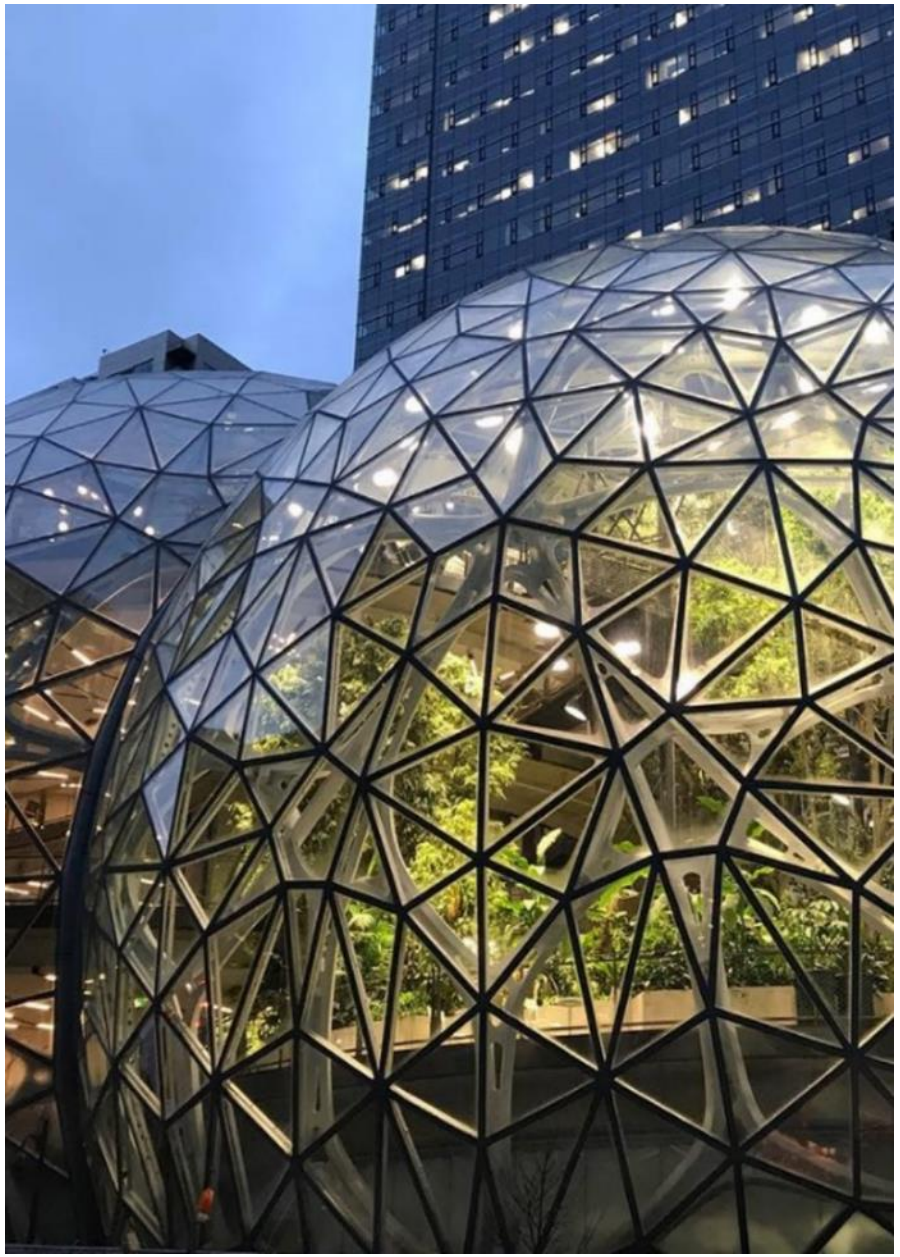
UNIFORM ILLUMINATION. A quality of illumination delivered by a lighting system typically comprised of similar fixtures mounted at a regular spacing interval. This lighting system provides a uniform contrast ratio of no greater that 5:1 maximum-to-minimum ratio throughout the entire area served, including task areas.

Lots of interest lately…

CONTROLLED PLANT GROWTH ENVIRONMENT. Group F and U buildings or spaces that are specifically controlled to facilitate and enhance plant growth and production by manipulating various indoor environmental conditions. Technologies include indoor agriculture, cannabis growing, hydroponics, aquaculture and aquaponics…

GREENHOUSE. A structure or a thermally isolated area of a building that maintains a specialized sunlit environment that is used exclusively for, and essential to, the cultivation, protection or maintenance of plants. Greenhouses are those that are erected for a period of 180 days or more.

TEMPORARY GROWING STRUCTURE. A temporary growing structure has sides and roof covered with polyethylene, polyvinyl or similar flexible synthetic material and is used to provide plants with either frost protection or increased heat retention. Temporary structures are those that are erected for a period of less than 180 days.



Chapter 4 Commercial Energy Efficiency a few highlights

C405.1 General. This section covers:

- lighting system controls,
- the maximum lighting power for interior and exterior applications,
- electrical energy consumption,
- vertical and horizontal transportation systems,

Dwelling units within multi-family buildings shall comply with Sections C405.1.1 and C405.7. All other dwelling units in dormitory, hotel and other residential occupancies that are not classified as multi-family residential occupancies shall comply with Section C405.2.5 and Section C405.1.1 or Section C405.4. *Sleeping units* shall comply with Section C405.2.5 and Section C405.1.1 or Section C405.4.

2018 Washington State Energy Code

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Controls- general

C405.2 Lighting controls. Lighting systems shall be provided with controls that comply with one of the following:

1. Lighting controls as specified in Sections C405.2.1 through C405.2.7.
2. *Luminaire level lighting controls (LLLC)* and lighting controls as specified in Sections C405.2.1, C405.2.3 and C405.2.5. The *LLLC luminaire* shall be independently configured to:
    - 2.1. Monitor occupant activity to brighten or dim lighting when occupied or unoccupied, respectively.
    - 2.2. Monitor ambient light, both electric and daylight, and brighten or dim artificial light to maintain desired light level.
    - 2.3. For each control strategy, configuration and re-configuration of performance parameters including: bright and dim set points, timeouts, dimming fade rates, sensor sensitivity adjustments, and wireless zoning configuration.

Controls- general- cont.

Exception: Except for specific application controls required by Section C405.2.5, lighting controls are not required for the following:

1. Areas designated as security or emergency areas that are required to be continuously lighted.
2. Means of egress illumination serving the exit access that does not exceed 0.02 watts per square foot of building area is exempt from this requirement..
3. Emergency egress lighting that is normally off.
4. Industrial or manufacturing process areas, as may be required for production and safety.

C405.2.1 to 405.2.8

C405.2.1 Occupancy sensor controls.

C405.2.2 Time switch controls.

C405.2.3 Manual controls.

C405.2.3.1 Light reduction controls.

C405.2.4 Daylight responsive controls.

C405.2.5 Additional lighting controls.

C405.2.6 Digital timer switch.

C405.2.7 Exterior lighting controls.

C405.2.5 Area controls. (was 405.2.8)

Occupancy controls- *location*. **Where are they required?**

C405.2.1 Occupant sensor controls. Occupant sensor controls shall be installed to control lights in the following space types:

1. Classrooms/lecture/training rooms.
2. Conference/meeting/multipurpose rooms.
3. Copy/print rooms.
4. Lounge/breakrooms.
5. Enclosed offices.
6. **Open plan office areas**.
7. Restrooms.
8. Storage rooms.
9. Locker rooms.
10. Other spaces 300 square feet (28 m2) or less that are enclosed by floor-to- ceiling height partitions.
11. Warehouse storage areas.
12. **Enclosed fire rated stairways.**
13. **Service corridors.**
14. **Covered parking areas.**

Pretty much EVERYWHERE

Occupancy sensor- *function*

What do they need to do.

C405.2.1.1 Occupant sensor control function.
Occupant sensor controls shall comply with all of the following:

1. They shall be configured to automatically turn off lights within 20 minutes of all occupants leaving the space.

2. They shall be manual on or shall be configured to automatically turn the lighting on to not more than 50 percent power.

Exception: Full *automatic*-on controls shall be permitted to control lighting in public corridors, stairways, restrooms, primary building entrance areas and lobbies, and areas where manual-on operation would endanger the safety or security of the room or building occupants.

3. They shall incorporate a manual control to allow occupants to turn lights off.

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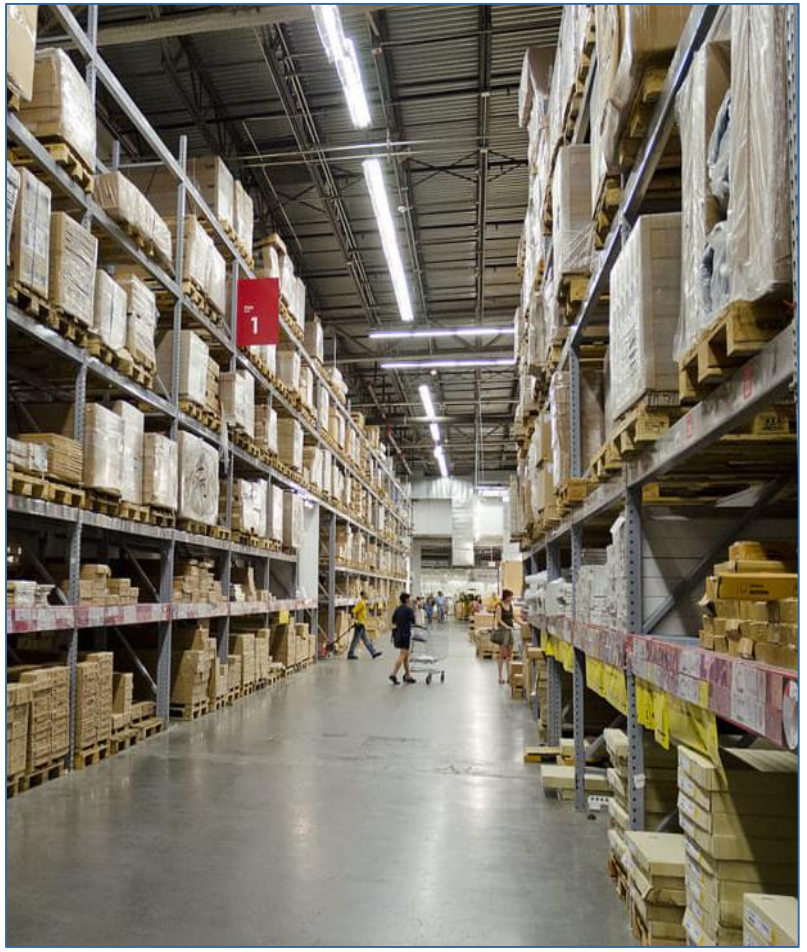
Occupancy sensor- function cont.

C405.2.1.2 Occupant sensor control function in warehouses, storage areas and service corridors. Occupant sensor controls shall be configured to comply with all of the following:

1. Automatically reduce lighting power by not less than 50 percent within **20** minutes of all occupants leaving the area.
2. Control lighting in each aisleway and corridor independently and shall not control lighting beyond the aisleway or corridor being controlled by the sensor.
3. Automatically turn lighting off within 20 minutes of all occupants leaving the space or comply with Section C405.2.2 to turn lighting off when the building is vacant.
4. Restore lighting to full power when occupants enter the space.



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Occupancy sensor- function cont.

C405.2.1.2 Occupant sensor control function in warehouses, storage areas and service corridors. Occupant sensor controls shall be configured to comply with all of the following:

C405.2.1.3 Occupant sensor control function in open plan office areas. Occupant sensor controls in open plan office spaces less than 300 square feet (28 m2) in area shall comply with Section C405.2.1.1. Occupant sensor controls in all other open plan office spaces shall be configured to comply with all of the following:

C405.2.1.4 Occupant sensor control function in parking garages. Occupant sensor controls shall be configured to comply with all of the following:

C405.2.1.5 Occupant sensor control function in enclosed fire rated stairways. Occupant sensor controls shall be configured to automatically reduce lighting power by not less than 50 percent when no occupants have been detected… All portions of stairways shall remain illuminated to meet the requirements of Section 1009 of the *IBC* when the lighting power is reduced.

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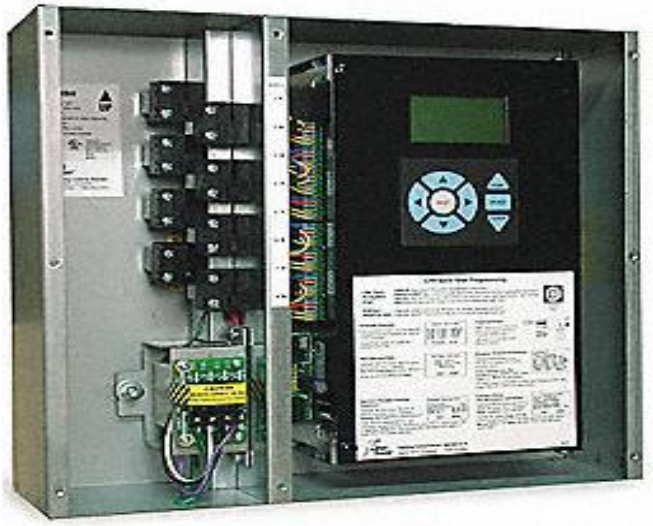
Time switch controls and Digital timer switch - Location



C405.2.2 Time switch controls. Each area of the building that is not provided with *occupant sensor controls* or digital timer switch controls complying with Section C405.2.1 shall be provided with time switch controls complying with Section C405.2.2.1.

Exception: Where a manual control provides light reduction in accordance with Section C405.2.3.1, time-switch controls shall not be required for the following:

1. Spaces where patient care is directly provided.
2. Spaces where an *automatic* shutoff would endanger occupant safety or security.
3. Lighting intended for continuous operation.
4. Shop and laboratory classrooms.

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Time switch controls- Function

C405.2.2.1 Time switch control function. Time switch controls shall comply with the following:

1. Have a minimum 7-day clock.

6. Time switch controls are allowed to automatically turn on lighting to **full** power in corridors, lobbies, restrooms, storage rooms less than 50 square feet, and medical areas of healthcare facilities. In all other spaces, time switch controls are allowed to automatically turn on the lighting to **not more than** 50 percent power.

Exception: Within mall concourses, auditoriums, sales areas, manufacturing facilities and sports arenas:

1.1. The time limit shall be permitted to be greater than 2 hours provided the switch is a captive key device.

1.2. The area controlled by the override switch shall not be limited to 5,000 square feet (465 m2) provided that such area is less than 20,000 square feet (1860 m2).

Manual controls.

C405.2.3 Manual controls. All lighting shall have manual controls complying with the following:

1. They shall be in a location with *ready access* to occupants.

2. They shall be located where the controlled lights are visible, or shall identify the area served by the lights and indicate their status.

3.

Exceptions:

1. A manual control may be installed in a remote location for the purpose of safety or security provided each remote control device has an indicator pilot light as part of or next to the control device and the light is clearly labeled to identify the controlled lighting.

2. Restrooms.

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Light reduction

C405.2.3.1 Light reduction controls. Manual controls shall be configured to provide light reduction control that allows the occupant to reduce the connected lighting load between 30 and 70 percent. Lighting reduction shall be achieved by one of the following *approved* methods:

1. Controlling all lamps or luminaires.
2. Dual switching of alternate rows of luminaires, alternate luminaires or alternate lamps.
3. Switching the middle lamp luminaires independently of the outer lamps.
4. Switching each luminaire or each lamp.

What do we call this?

And, what do we call this?

Exceptions:

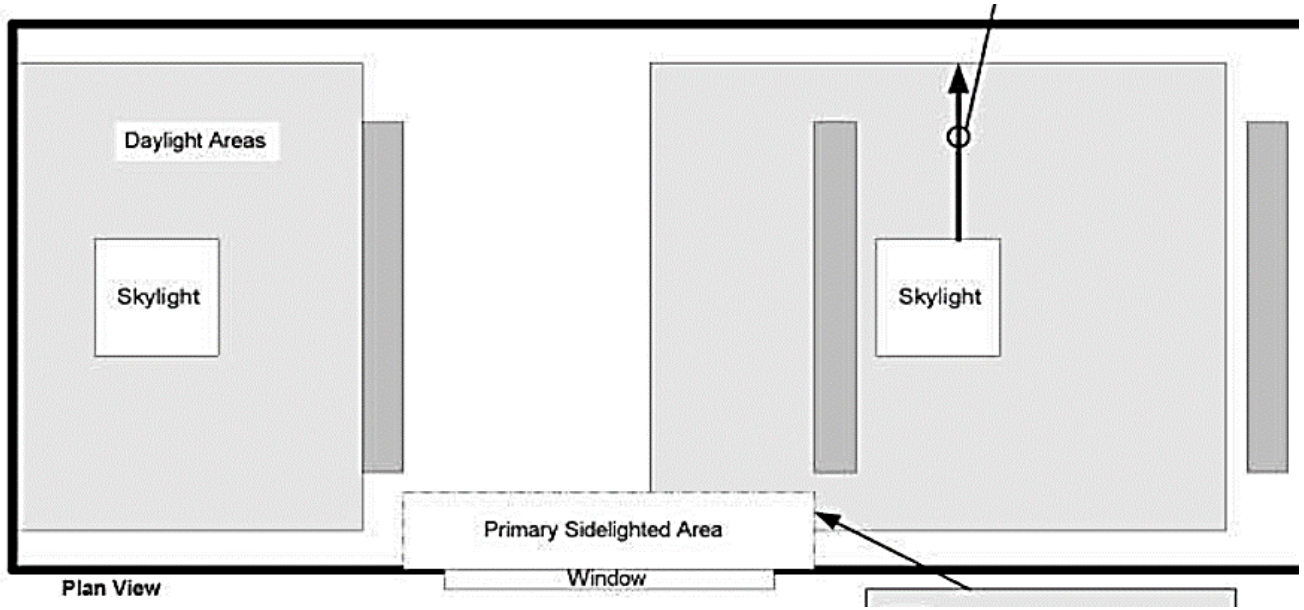
1. Light reduction controls are not required in daylight zones with *daylight responsive controls* complying with Section C405.2.4.
2. Where provided with manual control, the following areas are not required to have light reduction control:
    - 2.1. Spaces that have only one luminaire with a rated power of less than 100 watts.
    - 2.2. Spaces that use less than 0.6 watts per square foot (6.5 W/m2).
    - 2.3. Lighting in corridors, lobbies, electrical rooms, restrooms, storage rooms, airport concourse baggage areas, dwelling and sleeping rooms and mechanical rooms.

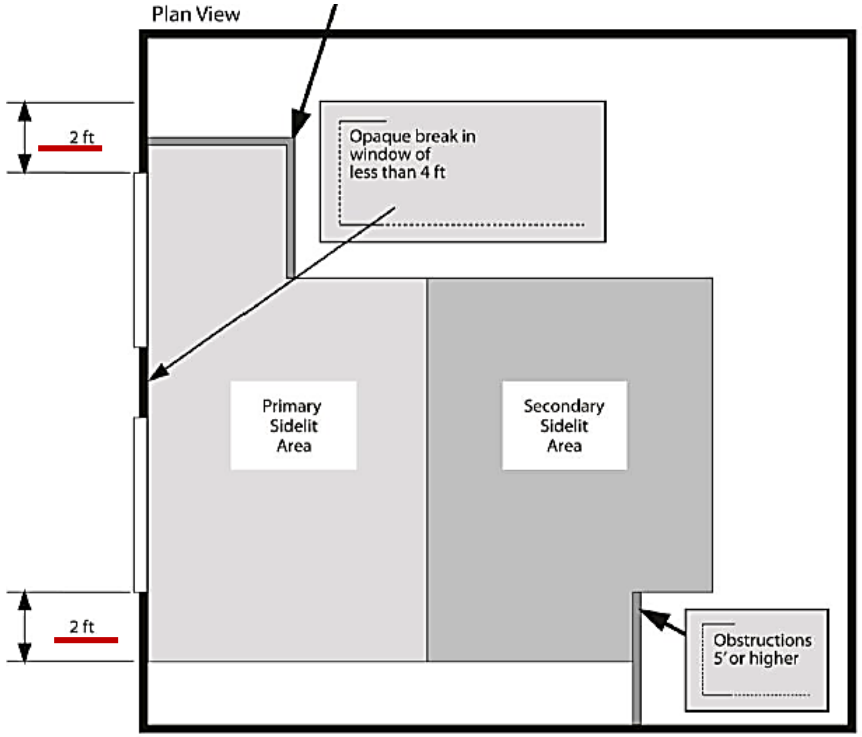
Daylight Zones- Primary and Secondary

C405.2.4 Daylight responsive controls. *Daylight responsive controls* complying with Section C405.2.4.1 shall be provided to control the lighting within *daylight zones* in the following spaces:

1. Side lit zones as defined in Section C405.2.4.2 with more than two general lighting fixtures within the combined primary and secondary sidelit zones.

2. Top lit zones as defined in Section C405.2.4.3 with more than two general lighting fixtures within the daylight zone.





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Daylight responsive controls

Exception: Daylight responsive controls are not required for the following:

1. Spaces in health care facilities where patient care is directly provided.
2. Lighting that is required to have specific application control in accordance with Section C405.2.5.
3. Sidelit zones on the first floor above grade in Group A-2 and Group M occupancies.
4. Daylight zones where the total proposed lighting power density is less than 35 percent of the lighting power allowance per Section C405.4.2.

Group A-2 occupancy includes assembly uses intended for food and/or drink consumption

Mercantile Group M occupancy includes, among others, the use of a building or structure or a portion thereof for the display and sale of merchandise,

2. Dwelling units and sleeping units.

Additional controls

C405.2.5 Additional lighting controls. Specific application lighting shall be provided with controls, in addition to controls required by other sections, for the following:

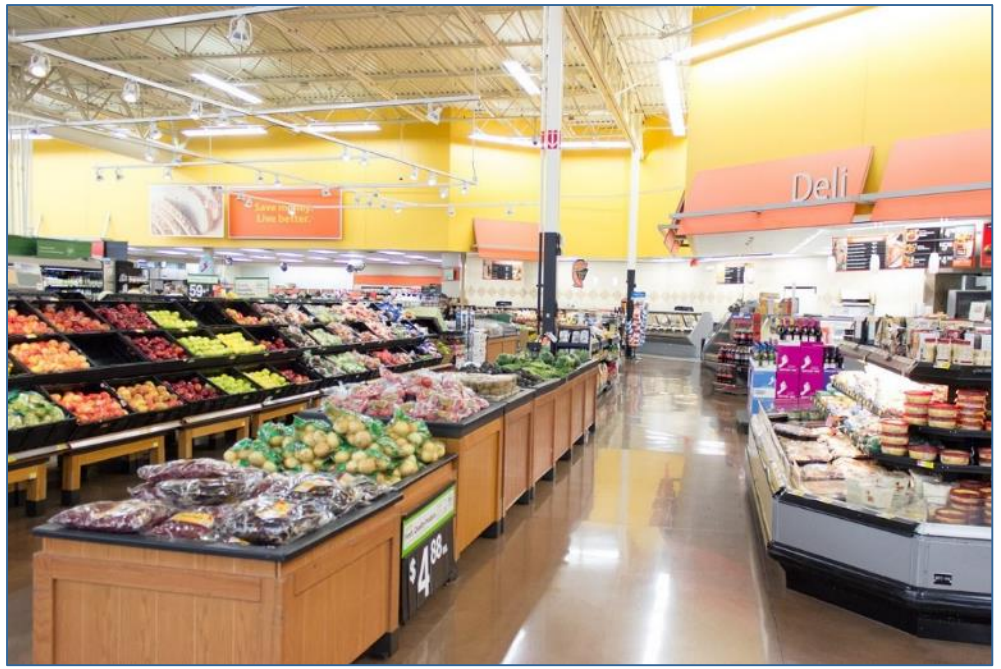
1. The following lighting shall be controlled by an occupant sensor complying with Section C405.2.1.1 or a time-switch control complying with Section C405.2.2.1 In addition, a manual control shall be provided to control such lighting separately from the general lighting in the space:

1.1. Display and accent.

1.2. Lighting in display cases.

1.3. Supplemental task lighting, including permanently installed under-shelf or under-cabinet lighting.

1.4. Lighting equipment that is for sale or demonstration in lighting education.

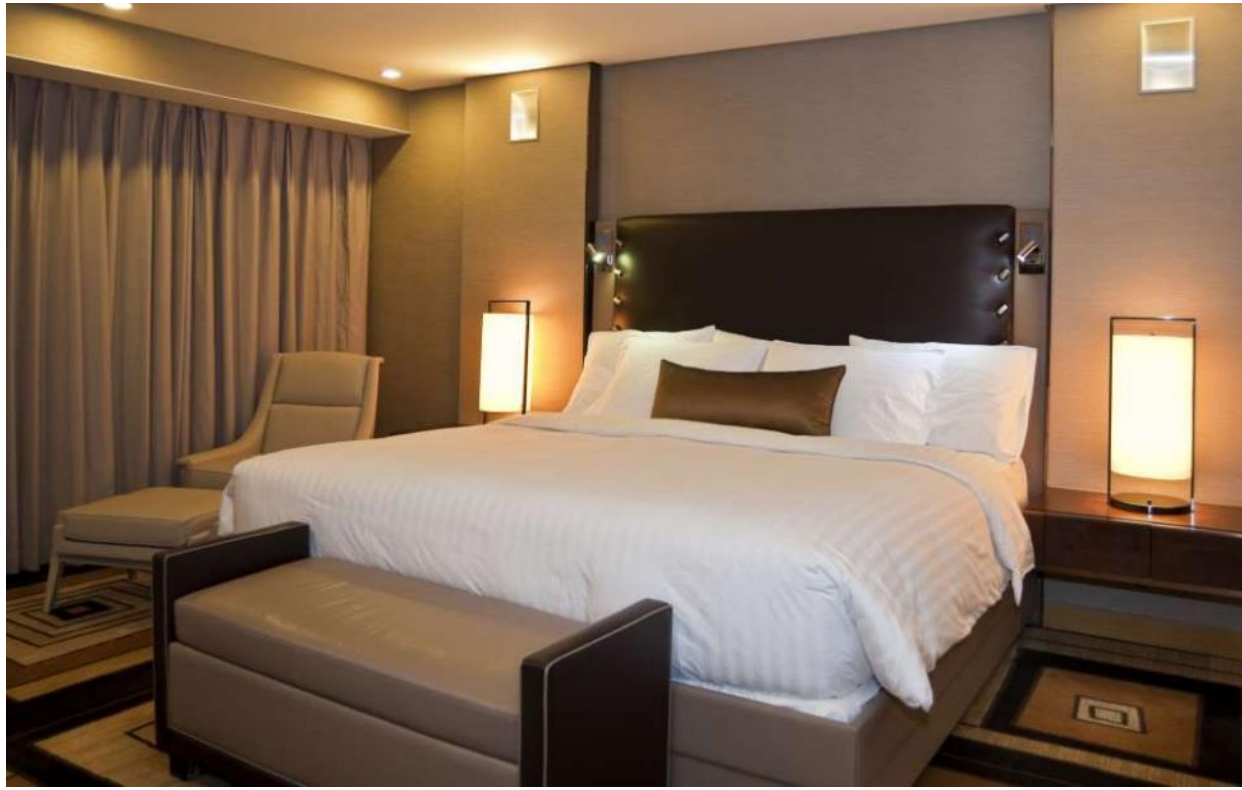


Additional controls cont.

2. *Sleeping units* shall have control devices or systems configured to automatically switch off all permanently installed luminaires and switched receptacles within 20 minutes after all occupants have left the unit.

Exceptions: 1.Lighting and switched receptacles controlled by card key controls. 2. Spaces where patient care is directly provided.

3. Permanently installed luminaires within dwelling units shall be provided with controls complying with either Section C405.2.1.1 or C405.2.3.1.



Additional controls cont.

4. Lighting for nonvisual applications, such as plant growth and food warming, shall be controlled by a dedicated control that is independent of the controls for other lighting within the room or space. Each control zone shall be no greater than the area served by a single luminaire or 4,000 square feet, whichever is larger.

5. Luminaires serving the exit access and providing means of egress illumination required by Section 1006.1 of the *International Building Code*, including luminaires that function as both normal and emergency means of egress illumination shall be controlled by a combination of listed emergency relay and occupancy sensors, or signal from another building control system, that automatically shuts off the lighting when the areas served by that illumination are unoccupied.*

> **Exception:** Means of egress illumination serving the exit access that does not exceed 0.02 watts per square foot of building area is exempt from this requirement.

*No more 24/7 “Safety Lights”

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Exterior controls

C405.2.6 Exterior lighting controls. Exterior lighting systems shall be provided with controls that comply with Sections C405.2.6.1 through C405.2.6.4. Decorative lighting systems shall comply with Sections C405.2.6.1, C405.2.6.2 and C405.2.6.4.

Exceptions:

1. Lighting for covered vehicle entrances or exits from buildings or parking structures where required for safety, security or eye adaption.
2. Lighting controlled from within dwelling units.

C405.2.6.1 Daylight shutoff. Lights shall be configured to automatically turn off when daylight is present and satisfies the lighting needs.

C405.2.6.2 Facade and landscape lighting shutoff. Building façade and landscape lighting shall be configured to automatically shut off for a minimum of 6 hours per night or from not later than one hour after business closing to not earlier than one hour before business opening, whichever is less.

Exception: Areas where an *automatic* shutoff would endanger safety or security.

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Exterior controls- cont.

C405.2.6.3 Lighting setback. Lighting that is not controlled in accordance with Section C405.2.6.2 shall be controlled so that the total wattage of such lighting is automatically reduced by not less than 30 percent by selectively switching off or dimming luminaires at one of the following times:

1. From not later than 12 midnight to 6 a.m.
2. From not later than one hour after business closing to not earlier than one hour before business opening.
3. During any period when no activity has been detected for 15 minutes or more.

C405.2.6.4 Exterior time-switch control functions. Time switch controls for exterior lighting shall comply with the following:

1. They shall have a clock capable of being programmed for not fewer than 7 days.
2. They shall be capable of being set for seven **different** day types per week.

Interior lighting power allowance

C405.4 Interior lighting power requirements. A building complies with this section **if** its total connected interior lighting power calculated under Section C405.4.1 is no greater than the interior lighting power allowance calculated under Section C405.4.2.

***TCLP* = [*LVL* + *BLL* + *TRK*+ *POE* + Other]**

TCLP = Total connected lighting power (watts)

LVL = For luminaires with lamps connected directly to building power, such as line voltage lamps, the rated wattage of the lamp, which must be minimum 60 lumen/watt.

BLL = For luminaires incorporating a ballast or transformer, the rated input wattage of the ballast or transformer when operating the lamp.

TRK = For lighting track, cable conductor, rail conductor and plug-in busway systems that allow the addition and relocation of luminaires without rewiring, the wattage shall be one of the following:

1. The specified wattage of the luminaires, but not less than **16** W/lin. ft*. (52 W/lin. m).
2. The wattage limit of the permanent current-limiting devices protecting the system.
3. The wattage limit of the transformer supplying the system.

* It used to be **50** W/lin.ft

POE = For other modular lighting systems served with power supplied by a driver, power supply or transformer, including but not limited to low-voltage lighting systems, the wattage of the system shall be the maximum rated input wattage of the driver, power supply or transformer published in the manufacturer's catalogs, as specified by UL 2108 or 8750. For power-over-Ethernet lighting systems, power provided to installed **non-lighting devices may be subtracted** from the total power rating of the power-over-Ethernet system.

Other = The wattage of **all other luminaires** and lighting, sources not covered above and associated with interior lighting verified by data supplied by the manufacturer or other *approved* sources

Interior lighting power Exceptions

The connected power associated with the following lighting equipment and applications is not included in calculating total connected lighting power

1. Television broadcast lighting for playing areas in sports arenas
2. Emergency lighting automatically off during normal building operation.
3. Lighting in spaces specifically designed for use by occupants with special lighting needs including those with visual impairment and other medical and age-related issues.
4. Casino gaming areas.
5. General area lighting power in industrial and manufacturing occupancies dedicated to the inspection or quality control of goods and products.
6. Mirror lighting in dressing rooms.
7. Task lighting for medical and dental purposes that is in addition to general lighting and controlled by an independent control device.

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A Lot more Exceptions Cont.

8. Display lighting for exhibits in galleries, museums and monuments that is in addition to general lighting and controlled by an independent control device.
9. Lighting for theatrical purposes, including performance, stage, film production and video production.
10. Lighting for photographic processes.
11. Lighting integral to equipment or instrumentation and installed by the manufacturer.
12. Task lighting for plant growth or maintenance where the lamp efficacy is not less than 90 lumens per watt.
13. Advertising signage or directional signage.
14. Lighting for food warming.
15. Lighting equipment that is for sale.
16. Lighting demonstration equipment in lighting education facilities.
17. Lighting *approved* because of safety considerations.
18. Lighting in retail display windows, provided the display area is enclosed by ceiling-height partitions.
19. Furniture mounted supplemental task lighting that is controlled by *automatic* shutoff.
20. Exit signs.
21. Lighting used for aircraft painting.

Two options

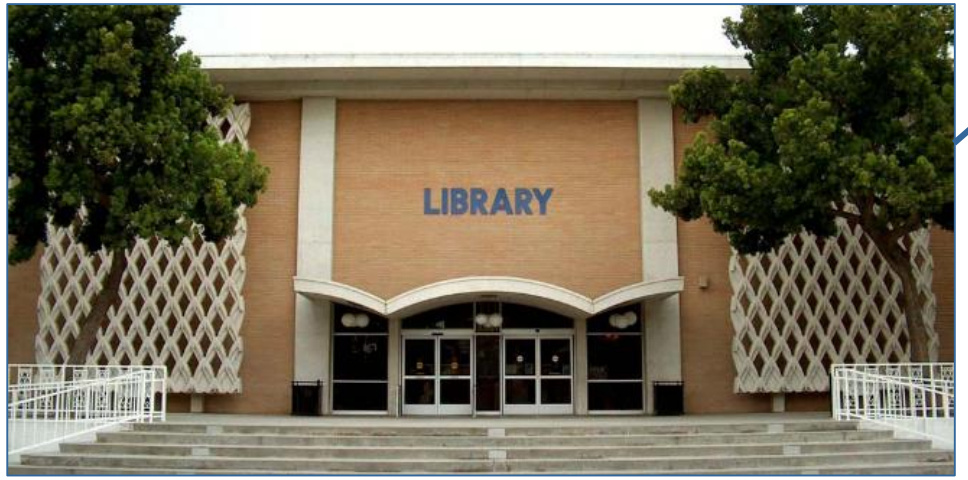
C405.4.2 Interior lighting power allowance. The total interior lighting power allowance (watts) is determined according to Table C405.4.2(1) using the **Building Area Method**, or Table C405.4.2(2) using the **Space-by-Space Method**, for all areas of the building covered in this permit.

C405.4.2.1 Building area method. For the Building Area Method, the interior lighting power allowance is the floor area for each building area type listed in Table C405.4.2(1) times the value from Table C405.4.2(1) for that area.

C405.4.2.2 Space-by-space method. For the Space-by-Space Method, the interior lighting power allowance is determined by multiplying the floor area of each space times the value for the space type in Table C405.4.2(2) that most closely represents the proposed use of the space, and then summing the lighting power allowances for all spaces. **Tradeoffs among spaces are permitted.**

Building area method C405.4.2.1

TABLE C405.4.2(1)
INTERIOR LIGHTING POWER ALLOWANCES:
BUILDING AREA METHOD



Building Area Type	LPD (w/ft²)
Automotive facility	0.64
Convention center	0.64
Court house	0.79
Dining: Bar lounge/leisure	0.79
Dining: Cafeteria/fast food	0.72
Dining: Family	0.71
Dormitory[a,b]	0.46
Exercise center	0.67
Fire station[a]	0.54
Gymnasium	0.75
Health care clinic	0.70
Hospital[a]	0.84
Hotel[a,b]	0.56
Library	0.83
Manufacturing facility	0.82
Motion picture theater	0.44
Multifamily[c]	0.41
Museum	0.55
Office	0.64
Parking garage	0.14
Penitentiary	0.65
Performing arts theater	0.84
Police station	0.66
Post office	0.65
Religious building	0.67
Retail	0.84
School/university	0.70
Sports arena	0.62
Town hall	0.69
Transportation	0.50
Warehouse	0.40

Building area method C405.4.2.1

TABLE C405.4.2(1)
INTERIOR LIGHTING POWER ALLOWANCES:
BUILDING AREA METHOD

Building Area Type	LPD (w/ft²)
Automotive facility	0.64
Convention center	0.64
Court house	0.79
Dining: Bar lounge/leisure	0.79
Dining: Cafeteria/fast food	0.72
Dining: Family	0.71
Dormitory[a,b]	0.46
Exercise center	0.67
Fire station[a]	0.54
Gymnasium	0.75
Health care clinic	0.70
Hospital[a]	0.84
Hotel[a,b]	0.56
Library	0.83
Manufacturing facility	0.82
Motion picture theater	0.44
Multifamily[c]	0.41
Museum	0.55
Office	0.64
Parking garage	0.14
Penitentiary	0.65
Performing arts theater	0.84
Police station	0.66
Post office	0.65
Religious building	0.67
Retail	0.84
School/university	0.70
Sports arena	0.62
Town hall	0.69
Transportation	0.50
Warehouse	0.40

Which is it?

Lighting Power Allowance over the years.

It's getting smaller…

WASHINGTON STATE ENERGY CODE Effective 7/01/98

TABLE 15-1
Unit Lighting Power Allowance (LPA)

Use[1]	LPA[2] (W/ft²)
Painting, welding, carpentry, machine shops	2.30
Barber shops, beauty shops	2.00
Hotel banquet/conference/exhibition hall[3,4]	2.00
Laboratories	2.00
Aircraft repair hangars	1.50
Cafeterias, fast food establishments[5]	1.50
Factories, workshops, handling areas	1.50
Gas stations, auto repair shops[6]	1.50
Institutions	1.50
Libraries[5]	1.50
Nursing homes	1.50
Wholesale stores (pallet rack shelving)	1.50
Mall concourses	1.40
School buildings, school classrooms, day care centers	1.35
Laundries	1.30
Office buildings, office/administrative areas in facilities of other use types (including but not limited to schools, hospitals, institutions, museums, banks, churches)[5,7]	1.20
Police and fire stations[8]	1.20
Atria (atriums)	1.00
Assembly spaces[9], auditoriums, gymnasia[9], theaters	1.00
Process plants	1.00
Restaurants/bars[5]	1.00
Retail A[10]	1.00
Retail B[10], retail banking	1.50
Locker and/or shower facilities	0.80
Warehouses[11], storage areas	0.50
Aircraft storage hangars	0.40
Parking garages	See Section 1532
Plans Submitted for Common Areas Only[7]	
Common area, corridors, lobbies (except mall concourse)	0.80
Toilet facilities, washrooms	0.80

2018 Washington State Energy Code

Building Area Type	LPD (w/ft²)
Automotive facility	0.64
Convention center	0.64
Court house	0.79
Dining: Bar lounge/leisure	0.79
Dining: Cafeteria/fast food	0.72
Dining: Family	0.71
Dormitory[a,b]	0.46
Exercise center	0.67
Fire station[a]	0.54
Gymnasium	0.75
Health care clinic	0.70
Hospital[a]	0.84
Hotel[a,b]	0.56
Library	0.83
Manufacturing facility	0.82
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Police station	0.66
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Religious building	0.67
Retail	0.84
School/university	0.70
Sports arena	0.62
Town hall	0.69
Transportation	0.50
Warehouse	0.40

Space-by-space C405.4.2.2

TABLE C405.4.2(2)

INTERIOR LIGHTING POWER ALLOWANCES: SPACE-BY-SPACE METHOD

COMMON SPACE-BY-SPACE TYPES[a]	LPD[d] (w/ft²)
Atrium - Less than 20 feet in height	0.39
Atrium – 20 to 40 feet in height	0.48
Atrium - Above 40 feet in height	0.60
Audience/seating area - Permanent	
In an auditorium	0.61
In a gymnasium	0.23
In an motion picture theater	0.27
In a penitentiary	0.67
In an performing arts theater	1.16
In a religious building	0.72
In a sports arena	0.33
Otherwise	0.23
Banking activity area	0.61
Breakroom (see Lounge/breakroom)	
Classroom/lecture hall/training room	
In a penitentiary	0.89
Otherwise[m]	0.71
Computer room, data center	0.94
Conference/meeting/multipurpose	0.97

Lounge /breakroom[n]	
In a health care facility	0.42
Otherwise	0.59
Office	
Enclosed ≤ 250	0.74
Enclosed >250	0.66
Open plan	0.61
Parking area, interior	0.15
Pharmacy area	1.66
Restroom	
In a facility for the visually impaired (and not used primarily by the staff)[b]	1.26
Otherwise[n]	0.63
Sales area	1.05
Seating area, general	0.23
Stairway (See space containing stairway)	
Stairwell[n]	0.49

Space-by-space C405.4.2.2

TABLE C405.4.2(2)

INTERIOR LIGHTING POWER ALLOWANCES: SPACE-BY-SPACE METHOD

Building Area- Office .64 W/sq'

COMMON SPACE-BY-SPACE TYPES[a]	LPD[d] (w/ft²)
Atrium - Less than 20 feet in height	0.39
Atrium – 20 to 40 feet in height	0.48
Atrium - Above 40 feet in height	0.60
Audience/seating area - Permanent	
In an auditorium	0.61
In a gymnasium	0.23
In an motion picture theater	0.27
In a penitentiary	0.67
In an performing arts theater	1.16
In a religious building	0.72
In a sports arena	0.33
Otherwise	0.23
Banking activity area	0.61
Breakroom (see Lounge/breakroom)	
Classroom/lecture hall/training room	
In a penitentiary	0.89
Otherwise[m]	0.71
Computer room, data center	0.94
Conference/meeting/multipurpose	0.97

Lounge /breakroom[n]	
In a health care facility	0.42
Otherwise	0.59
Office	
Enclosed ≤ 250	0.74
Enclosed >250	0.66
Open plan	0.61
Parking area, interior	0.15
Pharmacy area	1.66
Restroom	
In a facility for the visually impaired (and not used primarily by the staff)[b]	1.26
Otherwise[n]	0.63
Sales area	1.05
Seating area, general	0.23
Stairway (See space containing stairway)	
Stairwell[n]	0.49

Space-by-space C405.4.2.2 (footnotes)

c. For spaces in which lighting is specified to be installed **in addition to**, and controlled separately from, the general lighting for the purposed of **highlighting art or exhibits**, provided that the additional lighting power shall not exceed 0.5 W/ft2 of such spaces.

m. For **classrooms**, additional lighting power allowance of 4.50 W/lineal foot of white or chalk boards for **directional lighting dedicated to white or chalk boards.**

p. For **offices**, additional lighting power allowance of 0.20 W/square foot for **portable lighting**, which includes under shelf or furniture-mounted supplemental task lighting qualifies when controlled by a time clock or an occupancy sensor.

Lobby[c]	
In a facility for the visually impaired (and not used primarily by the staff)[b]	1.69
For an elevator	0.65
In a hotel	0.51
In a motion picture theater	0.23
In a performing arts theater	1.25
Otherwise	0.84

Classroom/lecture hall/training room	
In a penitentiary	0.89
Otherwise[m]	0.71

No foot note letter?

Office	
Enclosed ≤ 250	0.74
Enclosed >250	0.66
Open plan	0.61

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Space-by-space C405.4.2.2 (footnotes) cont.

Library[f]	
In a reading area[n]	0.31
In the stacks	1.10

n. Additional lighting power allowance of 0.30 W/square foot for **ornamental lighting**. *Qualifying* ornamental lighting includes luminaires such as chandeliers, sconces, lanterns, neon and cold cathode, light emitting diodes, theatrical projectors, moving lights and light color panels when any of those lights are used in a decorative manner that does not serve as display lighting or general lighting.

f. RESERVED. ??

2015 Code

f. The watts per square foot may be increased by 2 percent per foot of ceiling height above 9 feet. Footnote d may not be used for these occupancy types.

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Space-by-space: **Retail**

C405.4.2.2.1 Additional interior lighting power. …Additional power shall be permitted only where the specified lighting is installed and automatically controlled separately from the general lighting, to be turned off during nonbusiness hours.

The additional lighting power shall be determined in accordance with Equation 4-11:

Additional interior lighting power allowance = **500 watts** +
(Retail Area 1 x 0.45 W/ft2) + (Retail Area 2 x 0.45 W/ft2) +
(Retail Area 3 x 1.05 W/ft2) + (Retail Area 4 x 1.87 W/ft2)

Retail Area 1 = The floor area for all products not listed in Retail Area 2, 3 or 4.

Retail Area 2 = The floor area used for the sale of vehicles, sporting goods and small electronics.

Retail Area 3 = The floor area used for the sale of furniture, clothing, cosmetics and artwork.

Retail Area 4 = The floor area used for the sale of jewelry, crystal and china.

Exception: Other merchandise categories are permitted to be included in Retail Areas 2 through 4, provided that justification documenting the need for additional lighting power based on visual inspection, contrast, or other critical display is *approved* by the *code official*.

Exterior lighting

C405.5 Exterior lighting power requirements. The total connected exterior lighting power calculated in accordance with Section C405.5.2 shall not be greater than the exterior lighting power allowance calculated in accordance with Section C405.5.3.

C405.5.1 Exterior building grounds lighting. All exterior building grounds luminaires that operate at greater than 50 watts shall have a minimum efficacy of 100 lumens per watt unless the luminaire is controlled by a motion sensor or qualifies for one of the exceptions under Section C405.5.2.

Exceptions:

1. Solar-powered lamps not connected to any electrical service.
2. Luminaires controlled by a motion sensor.
3. Luminaires that qualify for one of the exceptions under Section C405.5.2.

Next slide

C405.5.2 Total connected exterior building lighting power. The total exterior connected lighting power shall be the total maximum rated wattage of all lighting that is powered through the energy service for the building.

C405.5.2 Exterior building lighting power (cont.) Exception.

1. Lighting approved because of safety considerations.
2. Emergency lighting automatically off during normal business operation.
3. Exit signs.
4. Specialized signal, directional and marker lighting associated with transportation.
5. Advertising signage or directional signage.
6. Integral to equipment or instrumentation and is installed by its manufacturer.
7. Theatrical purposes, including performance, stage, film production and video production.
8. Athletic playing areas.
9. Temporary lighting.
10. Industrial production, material handling, transportation sites and associated storage areas.
11. Theme elements in theme/amusement parks.
12. Lighting integrated within or used to highlight features of art, public monuments and the national flag.
13. Lighting for water features and swimming pools.
14. Lighting that is controlled from within dwelling units, where the lighting complies with Section R404.1

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Exterior lighting

C405.5.3 Exterior lighting power allowance. The total exterior lighting power allowance is the sum of the base site allowance plus the individual allowances for areas that are to be illuminated by lighting that is powered through the energy service for the building. Lighting power allowances are as specified in Table C405.5.3(2). The lighting zone for the building exterior is determined in accordance with Table C405.5.3(1) unless otherwise specified by the *code official*.

TABLE C405.5.3(1)
EXTERIOR LIGHTING ZONES

LIGHTING ZONE	DESCRIPTION
1	Developed areas of national parks, state parks, forest land, and rural areas
2	Areas predominantly consisting of residential zoning, neighborhood business districts, light industrial with limited nighttime use and residential mixed use areas
3	All other areas not classified as lighting zone 1, 2 or 4
4	High-activity commercial districts in major metropolitan areas as designated by the local land use planning authority

What zone is the City of Seattle?

TABLE C405.5.3(2) LIGHTING POWER ALLOWANCES FOR BUILDING EXTERIORS

	LIGHTING ZONES			
	Zone 1	**Zone 2**	**Zone 3**	**Zone 4**
Base Site Allowance	350 W	400 W	500 W	900 W
Uncovered Parking Areas				
Parking areas and drives	0.03 W/ft²	0.04 W/ft²	0.06 W/ft²	0.08 W/ft²
Building Grounds				
Walkways and ramps less than 10 feet wide	0.5 W/linear foot	0.5 W/linear foot	0.6 W/linear foot	0.7 W/linear foot
Walkways and ramps 10 feet wide or greater, plaza areas special feature areas	0.10 W/ft²	0.10 W/ft²	0.11 W/ft²	0.14 W/ft²
Dining areas	0.65 W/ft²	0.65 W/ft²	0.75 W/ft²	0.95 W/ft²
Stairways	0.6 W/ft²	0.7 W/ft²	0.7 W/ft²	0.7 W/ft²
Pedestrian tunnels	0.12 W/ft²	0.12 W/ft²	0.14 W/ft²	0.21 W/ft²
Landscaping	0.03 W/ft²	0.04 W/ft²	0.04 W/ft²	0.04 W/ft²
Building Entrances and Exits				
Pedestrian and vehicular entrances and exists	14 W/linear foot of opening	14 W/linear foot of opening	21 W/linear foot of opening	21 W/linear foot of opening
Entry canopies	0.2 W/ft²	0.25 W/ft²	0.4 W/ft²	0.4 W/ft²
Loading docks	0.35 W/ft²	0.35 W/ft²	0.35 W/ft²	0.35 W/ft²
Sales Canopies				
Free-standing and attached	0.4 W/ft²	0.4 W/ft²	0.6 W/ft²	0.7 W/ft²
Outdoor Sales				
Open areas (including vehicle sales lots)	0.2 W/ ft²	0.2 W/ ft²	0.35 W/ ft²	0.5 W/ ft²
Street frontage for vehicle sales lots in addition to "open area" allowance	No allowance	7 W/linear foot	7 W/linear foot	21 W/linear foot

For SI: 1 foot = 304.8 mm, 1 watt per square foot = W/0.0929 m².

TABLE C405.5.3(1)
EXTERIOR LIGHTING ZONES

LIGHTING ZONE	DESCRIPTION
1	Developed areas of national parks, state parks, forest land, and rural areas
2	Areas predominantly consisting of residential zoning, neighborhood business districts, light industrial with limited nighttime use and residential mixed use areas
3	All other areas not classified as lighting zone 1, 2 or 4
4	High-activity commercial districts in major metropolitan areas as designated by the local land use planning authority

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TABLE C405.5.3(3) INDIVIDUAL LIGHTING POWER ALLOWANCES FOR BUILDING EXTERIORS

	LIGHTING ZONES			
	Zone 1	Zone 2	Zone 3	Zone 4
Building facades	No Allowance	0.075 W/ft² of gross above-grade wall area	0.113 W/ft² of gross above-grade wall area	0.150 W/ft² of gross above-grade wall area
Automated teller machines (ATM) and night depositories	135 W per location plus 45 W per additional ATM per location			
Uncovered entrances and gatehouse inspection stations at guarded facilities	0.5 W/ft²			
Uncovered loading areas for law enforcement, fire, ambulance and other emergency service vehicles	0.35 W/ft²			
Drive-up windows/doors	200 W per drive-through			
Parking near 24-hour retail entrances	400 W per main entry			

TABLE C405.5.3(1)
EXTERIOR LIGHTING ZONES

LIGHTING ZONE	DESCRIPTION
1	Developed areas of national parks, state parks, forest land, and rural areas
2	Areas predominantly consisting of residential zoning, neighborhood business districts, light industrial with limited nighttime use and residential mixed use areas
3	All other areas not classified as lighting zone 1, 2 or 4
4	High-activity commercial districts in major metropolitan areas as designated by the local land use planning authority

C405.5.3.1 Additional exterior lighting power. Any increase in the exterior lighting power allowance is limited to the specific lighting applications indicated in Table C405.5.3(3). The additional power shall be used only for the luminaires that are serving these applications and shall not be used for any other purpose.

No Trading

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Pop Quiz- The two **methods** for calculating Interior Lighting Power are:

- Building Area Method.
- Accepted Method.
- Space-by-Space Method.
- Instrumental Method.
- Stanislavski Method.

In case you were wondering…

C405.5.4 Gas lighting. Gas-fired lighting appliances shall **not** be equipped with continuously burning pilot ignition systems.

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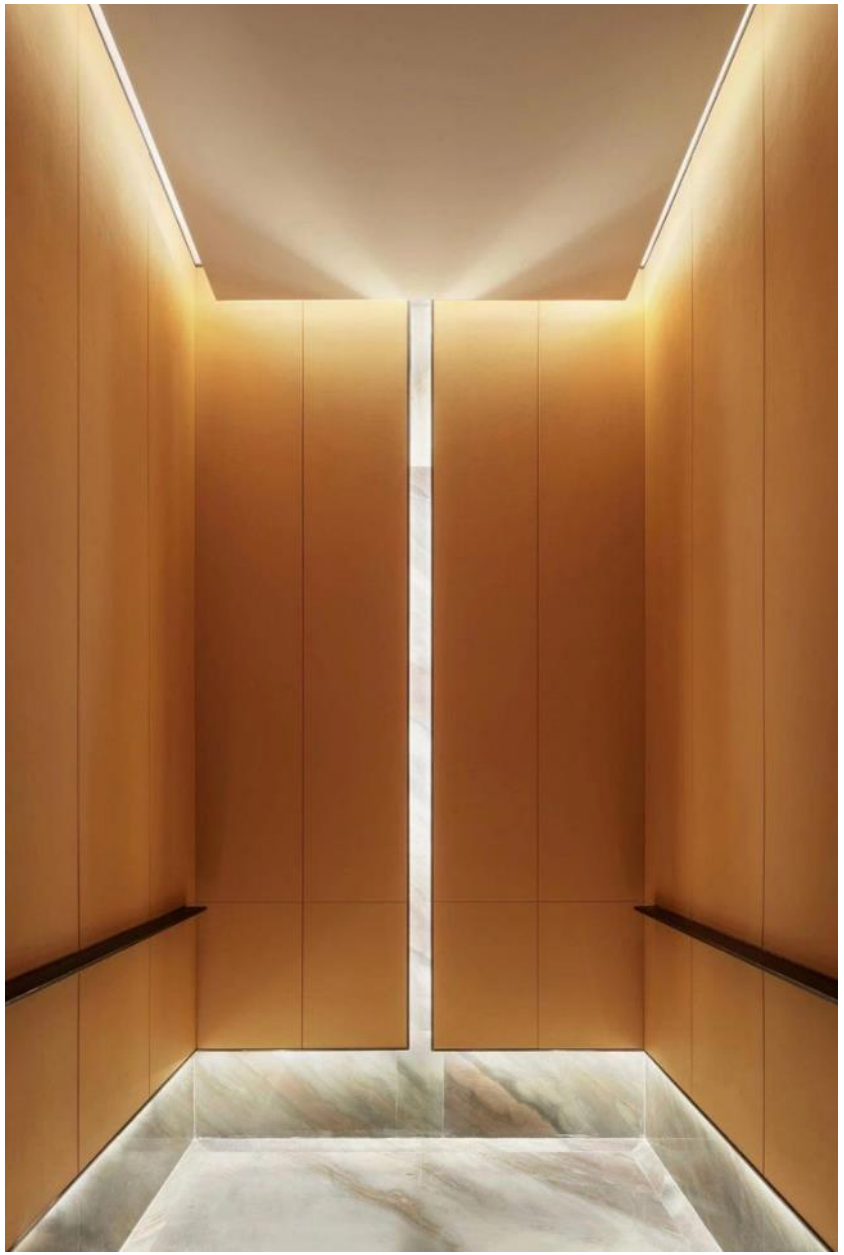
Elevators

C405.9 Vertical and horizontal transportation systems and equipment. Vertical and horizontal transportation systems and equipment shall comply with this section.

C405.9.1 Elevator cabs. For the luminaires in each elevator cab, not including signals and displays, the sum of the lumens divided by the sum of the watts shall be not less than 35 lumens per watt.

What does this mean?



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ASME American Society of Mechanical Engineers

CHAPTER 30

ELEVATORS AND CONVEYING SYSTEMS
(including 2017 errata)

Note: Chapter 30 is entirely Seattle amendments to the *International Building Code* and is not underlined.

3016.16 Elevator landing illumination. Elevators shall comply with ASME A17.1, 2.11.10.2 Illumination at Landing Sills, as amended below.

> **2.11.10.2 Illumination at Landing Sills**. The building corridors shall be so lighted that the illumination at the landing sills, when an elevator is in service, shall be not less than 100 lx (10 fc). Illumination under emergency power shall comply with Section 1008.

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But wait there's more…

C405.10 Controlled receptacles. At least 50 percent of all 125 volt 15- and 20-ampere receptacles installed in private offices, open offices, conference rooms, rooms used primarily for printing and/or copying functions, break rooms, individual workstations and classrooms, including those installed in modular partitions and modular office workstation systems, shall be controlled as required by this section. …

Controlled receptacles shall be visibly differentiated from standard receptacles and shall be controlled by one of the following *automatic* control devices:

1. An occupant sensor that turns receptacle power off when no occupants have been detected for a maximum of 20 minutes.
2. A time-of-day operated control device that turns receptacle power off at specific programmed times and can be programmed separately for each day of the week. …

Exception: Receptacles designated for specific equipment requiring 24-hour operation, for building maintenance functions, or for specific safety or security equipment are not required to be controlled by an *automatic* control device…

Section C406 Efficiency Packages

C406.1 Additional energy efficiency credit requirements. New buildings and changes in space conditioning, change of occupancy and building additions in accordance with Chapter 5 shall comply with sufficient packages from Table C406.1 so as to achieve a minimum number of six credits. …

Exceptions:

1. Low energy spaces in accordance with Section C402.1.1.1 and equipment buildings in accordance with Section C402.1.2 shall comply with sufficient packages from Table C406.1 to achieve a minimum number of three credits.
2. Building additions that have less than 1,000 square feet of *conditioned floor area* shall comply with sufficient packages from Table C406.1 to achieve a minimum number of three credits.

TABLE C406.1
EFFICIENCY PACKAGE CREDITS

Code Section	Commercial Building Occupancy					
	Group R-1	Group R-2	Group B	Group E	Group M	All Other
	Additional Efficiency Credits					
1. More efficient HVAC performance in accordance with Section C406.2	2.0	3.0	3.0	2.0	1.0	2.0
2. Reduced lighting power: Option 1 in accordance with Section C406.3.1	1.0	1.0	2.0	2.0	3.0	2.0
3. Reduced lighting power: Option 2 in accordance with Section C406.3.2[a]	2.0	3.0	4.0	4.0	6.0	4.0
4. Enhanced lighting controls in accordance with Section C406.4	NA	NA	1.0	1.0	1.0	1.0
5. On-site supply of renewable energy in accordance with C406.5	3.0	3.0	3.0	3.0	3.0	3.0
6. Dedicated outdoor air system in accordance with Section C406.6[b]	4.0	4.0	4.0	NA	NA	4.0
7. High performance dedicated outdoor air system in accordance with Section C406.7	4.0	4.0	4.0	4.0	4.0	4.0
8. High-efficiency service water heating in accordance with Sections C406.8.1 and C406.8.2	4.0	5.0	NA	NA	NA	8.0
9. High performance service water heating in multi-family buildings in accordance with Section C406.9	7.0	8.0	NA	NA	NA	NA
10. Enhanced envelope performance in accordance with Section C406.10[c]	3.0	6.0	3.0	3.0	3.0	4.0
11. Reduced air infiltration in accordance with Section C406.11[c]	1.0	2.0	1.0	1.0	1.0	1.0
12. Enhanced commercial kitchen equipment in accordance with Section C406.12	5.0	NA	NA	NA	5.0	5.0 (Group A-2 only)

Occupancy Classification

Description	Group(s)
Assembly (A)	A-1, A-2, A-3, A-4, A-5
Business (B)	B
Educational (E)	E
Factory and Industrial (F)	F-1, F-2
High Hazard (H)	H-1, H-2, H-3, H-4, H-5
Institutional (I)	I-1, I-2, I-3, I-4
Mercantile (M)	M
Residential (R)	R-1, R-2, R-3, R-3.1, R-4
Storage (S)	S-1, S-2
Utility and Miscellaneous (U)	U

[a] Projects using this option may not use Item 2

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C406.3 Reduced lighting power.

Interior lighting within the whole building, building addition or tenant space shall comply with Section C406.3.1 or C406.3.2. Dwelling units and sleeping units within the building shall comply with Section C406.3.3.

C406.3.1 Reduced lighting power option 1. The total connected interior lighting power calculated in accordance with Section C405.4.1 shall be 90 percent or less of the lighting power values specified in Table C405.4.2(1) times the floor area for the building types…

C406.3.2 Reduced lighting power option 2. The total connected interior lighting power calculated in accordance with Section C405.4.1 shall be 80 percent or less of the lighting power values specified in Table C405.4.2(1) times the floor area for the building types…

C406.3.3 Lamp fraction. No less than 95 percent of the permanently installed light fixtures in dwelling units and sleeping units shall be provided by high efficacy lamps with a minimum efficacy of 65 lumens per watt.

TABLE C405.4.2(1)

Building Area Type	LPD (w/ft^2)
Automotive facility	0.64
Convention center	0.64
Court house	0.79
Dining: Bar lounge/leisure	0.79
Dining: Cafeteria/fast food	0.72
Dining: Family	0.71
Dormitory[a,b]	0.46
Exercise center	0.67
Fire station[a]	0.54
Gymnasium	0.75
Health care clinic	0.70
Hospital[a]	0.84
Hotel[a,b]	0.56
Library	0.83
Manufacturing facility	0.82
Motion picture theater	0.44
Multifamily[c]	0.41
Museum	0.55
Office	0.64
Parking garage	0.14
Penitentiary	0.65
Performing arts theater	0.84
Police station	0.66
Post office	0.65
Religious building	0.67
Retail	0.84
School/university	0.70
Sports arena	0.62
Town hall	0.69
Transportation	0.50
Warehouse	0.40
Workshop	0.91

C406.4 Enhanced digital lighting controls and Exceptions

No less than 90 percent of the total installed interior lighting power within the whole building, building addition or tenant space shall comply with Section C406.4.1.

C406.4.1 Lighting controls function. Interior lighting shall be located, scheduled and operated in accordance with Section C405.2, and shall be configured with the following enhanced control functions:

1. Luminaires shall be configured for continuous dimming.
2. Each luminaire shall be individually addressed.

Exceptions to Item 2:

1. Multiple luminaires mounted on no more than 12 linear feet of a single lighting track and addressed as a single luminaire.
2. Multiple linear luminaires that are ganged together to create the appearance of a single longer fixture and addressed as a single luminaire, where the total length of the combined luminaires is not more than 12 feet.

3. No more than eight luminaires within a *daylight zone* are permitted to be controlled by a single *daylight responsive control*.

C406.4 Enhanced digital lighting controls and Exceptions- cont.

4. Luminaires shall be controlled by a digital control system configured with the following capabilities:

   4.1. Scheduling and illumination levels of individual luminaires and groups of luminaires are capable of being reconfigured through the system.

   4.2. Load shedding.

   4.3. In open and enclosed offices, the illumination level of overhead general illumination luminaires are configured to be individually adjusted by occupants.

   4.4. Occupancy sensors and daylight responsive controls are capable of being reconfigured through the system.

5. Construction documents shall include submittal of a Sequence of Operations, including a specification outlining each of the functions required by this section.

Existing Buildings- Section C501 General

C501.1 Scope. The provisions of this chapter shall control the *alteration*, *repair*, *addition* and change of occupancy of existing buildings and structures.

C501.2 Existing buildings. Except as specified in this chapter, this code shall not be used to require the removal, *alteration* or abandonment of, nor prevent the continued use and maintenance of, an existing building or building system lawfully in existence at the time of adoption of this code.

C501.4 Compliance. *Alterations*, *repairs*, *additions* and changes of occupancy to, or relocation of, existing buildings and structures shall comply with the provisions for *alterations*, *repairs*, *additions* and changes of occupancy or relocation, respectively, in this code and in the ***International Building Code***, *International Existing Building Code, International Fire Code*, *International Fuel Gas Code*, *International Mechanical Code*, *Uniform Plumbing Code*, and **NFPA 70**.

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Existing Buildings- Section C502 General

C502.1 General. ***Additions*** to an existing building, building system or portion thereof shall conform to the provisions of this code as they relate to new construction without requiring the unaltered portion of the existing building or building system to comply with this code. Additions shall not create an unsafe or hazardous condition or overload existing building systems. An addition shall be deemed to comply with this code if the addition alone complies or if the existing building and addition comply with this code as a single building. Additions shall comply with Sections C402, C403, C404, **C405**, **C406**, C409.5, C410 and C502.2.

C502.2.6 Lighting and power systems. New lighting systems that are installed as part of the addition shall comply with Section C405.

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Existing Buildings- Section C503 Alterations

C503.1 General. Alterations to any building or structure shall comply with the requirements of Section C503 **and** the code for new construction. Alterations to an existing building, building system or portion thereof shall conform to the provisions of this code as they relate to new construction without requiring the unaltered portions of the existing building or building system to comply with this code.

> **C503.6.1 Luminaire additions and alterations.** Alterations that add or replace 50 percent or more of the luminaires in a space…, replace 50 percent or more of parking garage luminaires, or replace 50 percent or more of the total installed wattage of exterior luminaires shall comply with Sections C405.4 and C405.5. Where less than 50 percent of the fixtures… the installed lighting wattage shall be maintained or reduced.

Seattle

C503.6.1 Luminaire additions and alterations. Alterations that add, alter or replace ~~((50))~~ 20 percent or more of the luminaires or of the lamps plus ballasts alone in a space enclosed by walls or ceiling-height partitions, replace ~~((50))~~ 20 percent or more of parking garage luminaires, or replace ~~((50))~~ 20 percent or more of the total installed wattage of exterior luminaires shall comply with Sections C405.4 and C405.5.

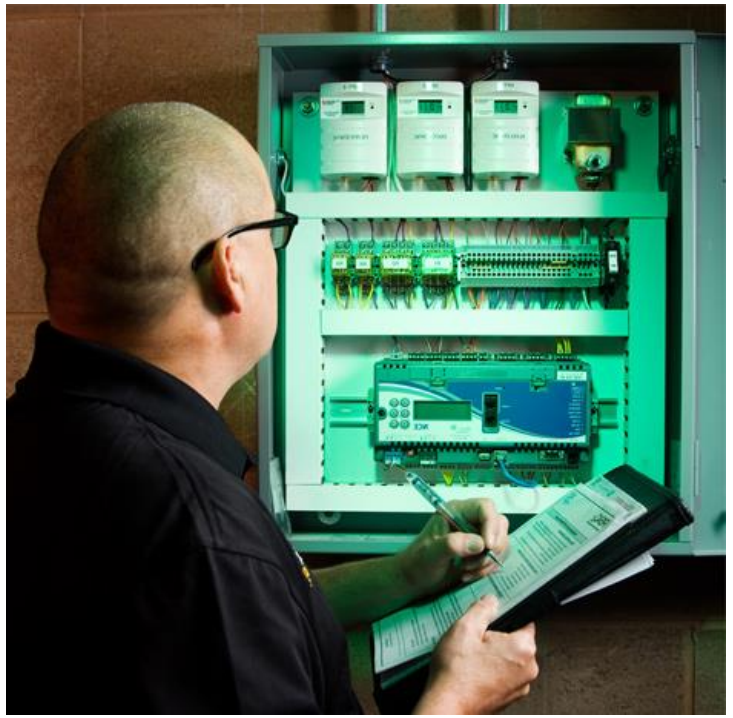
Section C408 System Commissioning

C408.1 General. A building commissioning process led by a *certified commissioning professional* and functional testing requirements shall be completed for mechanical systems in Section C403; service water heating systems in Section C404; controlled receptacle and lighting control systems in Section C405; equipment, appliance and systems installed to comply with Section C406 or C407;senergy metering in Section C409; and refrigeration systems in Section C410.

C408.4 Controlled receptacle and lighting control system commissioning. Controlled receptacles and lighting control systems subject to Section C405 shall be included in the commissioning process required by Section C408.1. The configuration and function of controlled receptacles and lighting control systems required by this code shall be tested and shall comply with Section C408.4.1.

Exception: Lighting control systems are exempt from the commissioning process in buildings where:

1. The total installed lighting load is less than 20 kW, **and**
2. The lighting load controlled by occupancy sensors or *automatic* daylighting controls is less than 10 kW.



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What is commissioning?

"…*A systematic* **process** *that ensures that* **all elements** *of the …control system* **perform interactively** *and continuously according to documented* **design intent** *and the* **needs** *of the building owner…"*

IESNA Handbook, 9th Edition

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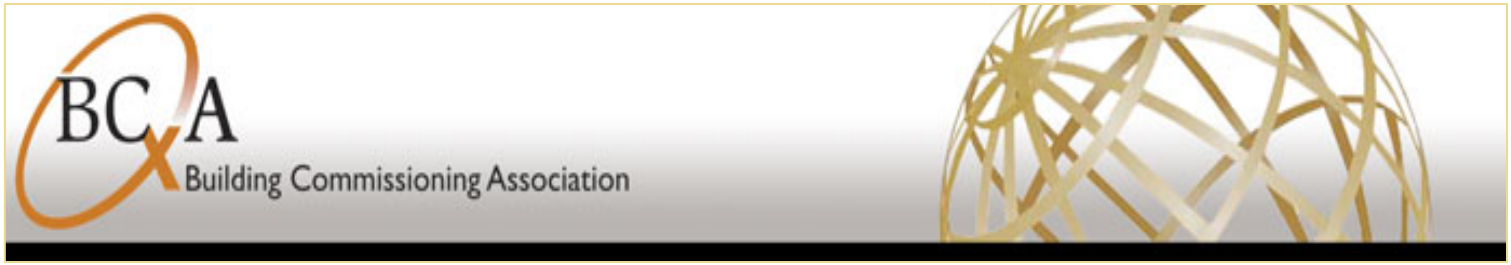
What is commissioning?

Definition

ASHRAE Guideline 0, The Commissioning Process, defines commissioning as:

"a quality-oriented **process** for achieving, verifying, and documenting that the performance of facilities, systems, and assemblies **meets <u>defined objectives</u>** and **criteria".**

What is commissioning?



We define the basic purpose of commissioning as follows: *"The basic purpose of building commissioning is to **provide documented confirmation** that building systems function in **compliance with criteria set forth** in the Project Documents to satisfy the owner's operational needs. Commissioning of existing systems may require the development of new functional criteria in order to address the owner's current systems performance requirements."*

http://www.bcxa.org/

Commissioning

Pre-Design- Commissioning should begin early in the design process

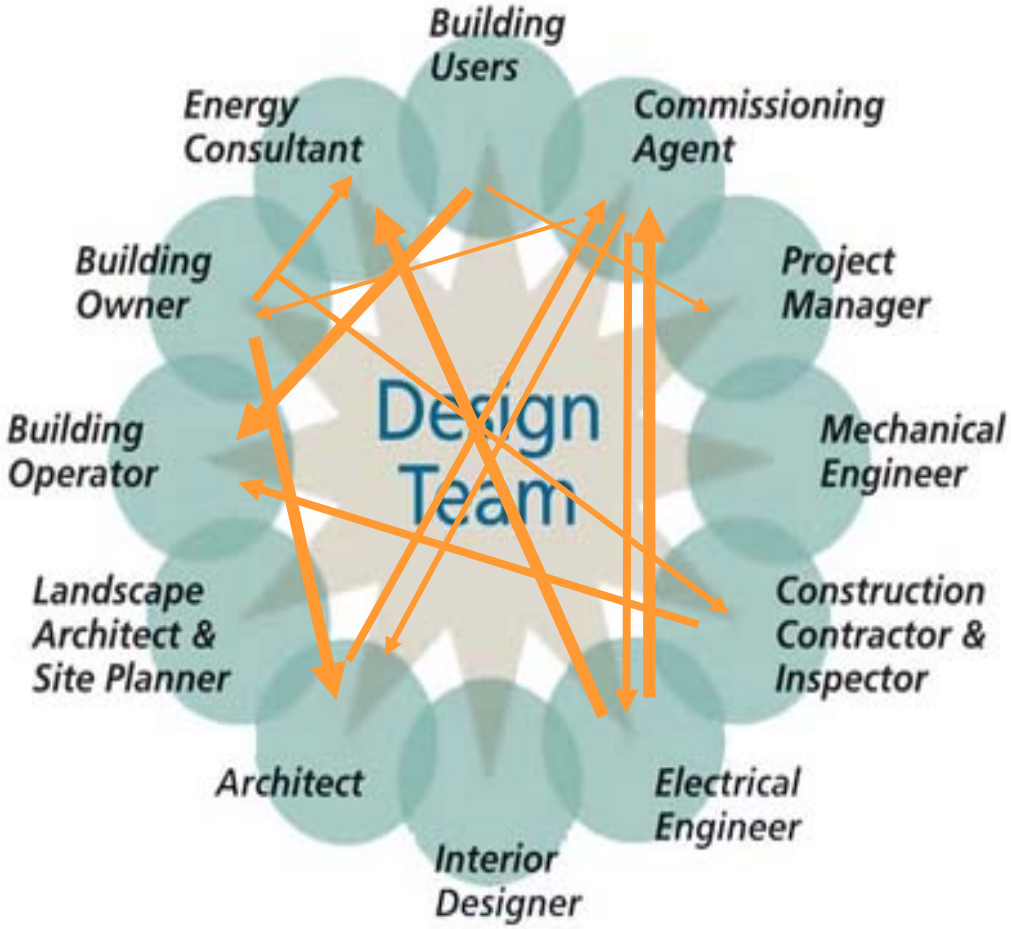
Who is responsible for Lighting Commissioning?

Roles for design and implementation need to be clearly defined.

For the system to perform properly it must be;

- Designed
- Specified
- Ordered
- Installed
- Set-up
- Commissioned and
- Operated

…correctly or it will not deliver the expected results.



Pop Quiz- The WSEC addresses areas as diverse as:

- Elevators
- Egress lighting
- Receptacles
- Commissioning
- Additions

LEED v4

LEED, Leadership in Energy & Environmental Design, is a green building certification program that recognizes best-in-class building strategies and practices.

LEED

www.usgbc.org

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LEED Option 2. Lighting Quality-(1 Pt)

Choose **four** of the following strategies

A. For all regularly occupied spaces, use light fixtures with a luminance of less than 2,500 cd/m2 between 45 and 90 degrees from nadir.

Exceptions include wallwash fixtures properly aimed at walls, …

B. For the entire project, use light sources with a CRI of 80 or higher. Exceptions include lamps or fixtures specifically designed to provide colored lighting for effect, site lighting, or other special use.

C. For at least 75% of the total connected lighting load, use light sources that have a rated life (or L70 for LED sources) of at least 24,000 hours (at 3-hour per start, if applicable).

D. Use direct-only overhead lighting for 25% or less of the total connected lighting load for all regularly occupied spaces.

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LEED Option 2. Lighting Quality-(1 Pt)

Choose four of the following strategies -cont.

E. For at least 90% of the regularly occupied floor area, meet or exceed the following thresholds for area-weighted average surface reflectance: 85% for ceilings, 60% for walls, and 25% for floors.

F. If furniture is included in the scope of work, select furniture finishes to meet or exceed the following thresholds for area-weighted average surface reflectance: 45% for work surfaces, and 50% for movable partitions.

G. For at least 75% of the regularly occupied floor area, meet a ratio of average wall surface illuminance (excluding fenestration) to average work plane (or surface, if defined) illuminance that does not exceed 1:10. Must also meet strategy E, strategy F, or demonstrate area-weighted surface reflectance of at least 60% for walls.

H. For at least 75% of the regularly occupied floor area, meet a ratio of average ceiling illuminance (excluding fenestration) to work surface illuminance that does not exceed 1:10. Must also meet strategy E, strategy F, or demonstrate area-weighted surface reflectance of at least 85% for ceilings.

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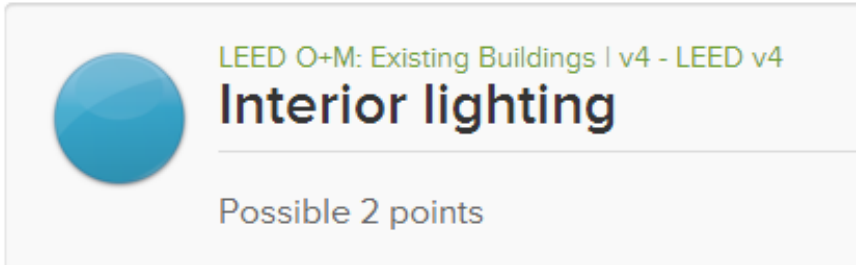

Option 1. Lighting control (1 point)

For at least 50% of individual occupant spaces, have in place individual lighting controls that *enable occupants to adjust the lighting* to suit their individual tasks and preferences, with at least three lighting levels or scenes (on, off, midlevel). Midlevel is 30% to 70% of the maximum illumination level (not including daylight contributions).

For all shared multi-occupant spaces, meet all of the following requirements.

- Have in place multi-zone control systems that *enable occupants to adjust* the lighting to meet group needs and preferences, with at least three lighting levels or scenes (on, off, midlevel).
- Lighting for any presentation or projection wall must be separately controlled.
- Switches or manual *controls must be located in the same space* as the controlled luminaires. A person operating the controls must have a direct line of sight to the controlled luminaires.

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LIGHT

The WELL Building Standard™ (WELL) provides guidelines that minimize disruption to the body's circadian system, enhance productivity, support good sleep quality and provide appropriate visual acuity.

LIGHT FEATURES

FEATURE 53 Visual lighting design VIEW	FEATURE 54 Circadian lighting design VIEW	FEATURE 55 Electric light glare control VIEW
FEATURE 56 Solar glare control VIEW	FEATURE 57 Low-glare workstation design VIEW	FEATURE 58 Color quality VIEW
FEATURE 59 Surface design VIEW	FEATURE 60 Automated shading and dimming controls VIEW	FEATURE 61 Right to light VIEW
FEATURE 62 Daylight modeling VIEW	FEATURE 63 Daylighting fenestration VIEW	FEATURE P2 Light at night VIEW

AIR
WATER
NOURISHMENT
LIGHT
FITNESS
COMFORT
MIND

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FEATURE—BEYOND EFFICIENCY

All-Electric Buildings: Electrification in the Code

Mike Stone,
West Coast Field
Representative,
NEMA

Various energy codes across the country are beginning to address the concept of electrification. These codes include the (IECC), ASHRAE 90.1, and California's Title 24

At the 2021 IECC code development hearings last year, NEMA assisted one of our industry partners in drafting an electrification proposal which was ultimately successful. **This new code language requires that any appliance location in a dwelling unit that has a natural gas supply must also be provided with an equivalent electrical circuit.** As of this writing, several of the opponents to this code change have filed an appeal with ICC to have it removed. But if the appeal is denied, the new requirement will be in the 2021 IECC edition.

MIT News

ON CAMPUS AND AROUND THE WORLD

Becky Ham | MIT News correspondent
May 9, 2019

Ambient plant illumination could light the way for greener buildings

Collaboration between MIT architect and chemical engineer could be at the center of new sustainable infrastructure for buildings.

The light-emitting plants are not genetically modified to produce light. Instead, they are **infused with nanoparticles that turn the plant's stored energy into light**, similar to how fireflies glow.

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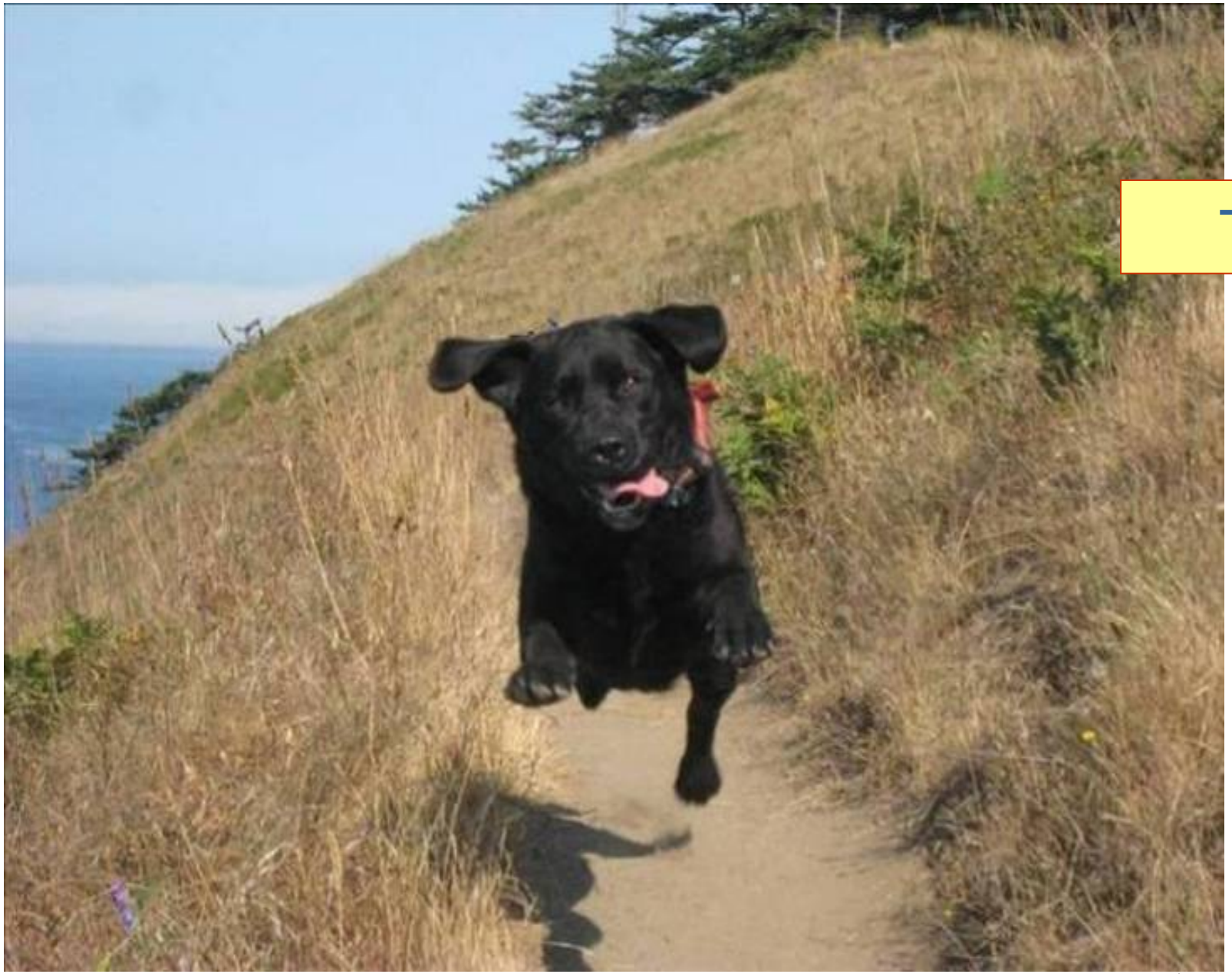

Thank You!

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And now – a few words from LDL

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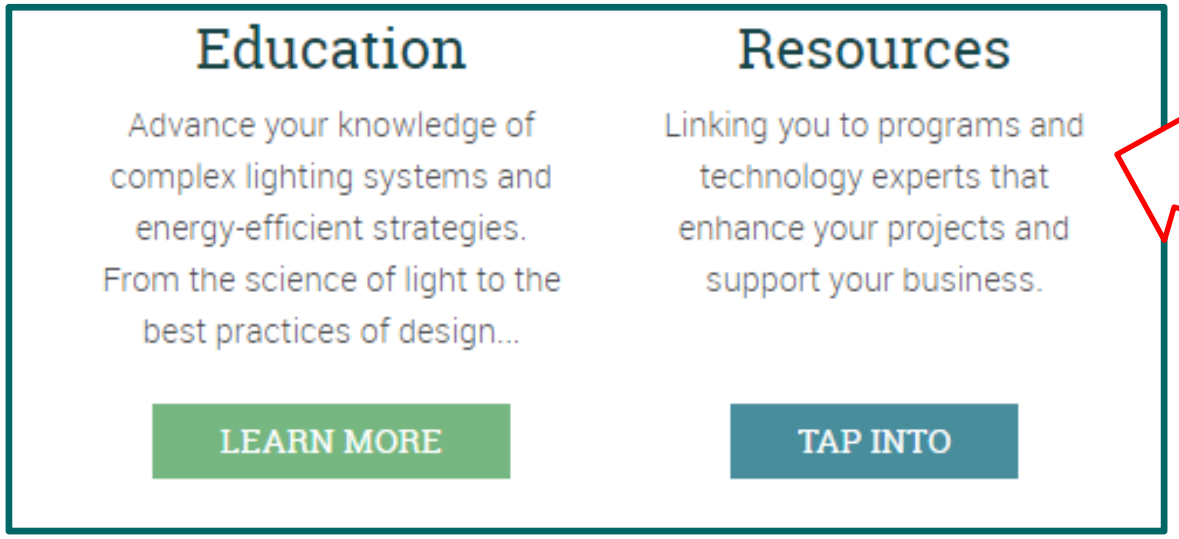
Visit us online



OR

Email Us

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Todays slide deck will be posted here!

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We'll *SEE* you on the next call… ☺

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