



TITLE 24, PART 6

2028 CODE CYCLE



Indoor Lighting Power Density & Luminaire Classification

Codes and Standards Enhancement (CASE) Proposal

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What's New Since Our Last Stakeholder Meeting?

New / Updated

- ✓ Background on AB130 implications for impacted space types
- ✓ Lighting Power Density (LPD) value updates
- ✓ Model assumptions and draft language details
- ✓ Preliminary Incremental Costs, Savings and Cost-Effectiveness for general (base) lighting
- ✓ Luminaire classification and labeling proposal

In Progress

- Simplified approach for display and ornamental lighting for fine dining and retail
- Refined analysis based on stakeholder comments

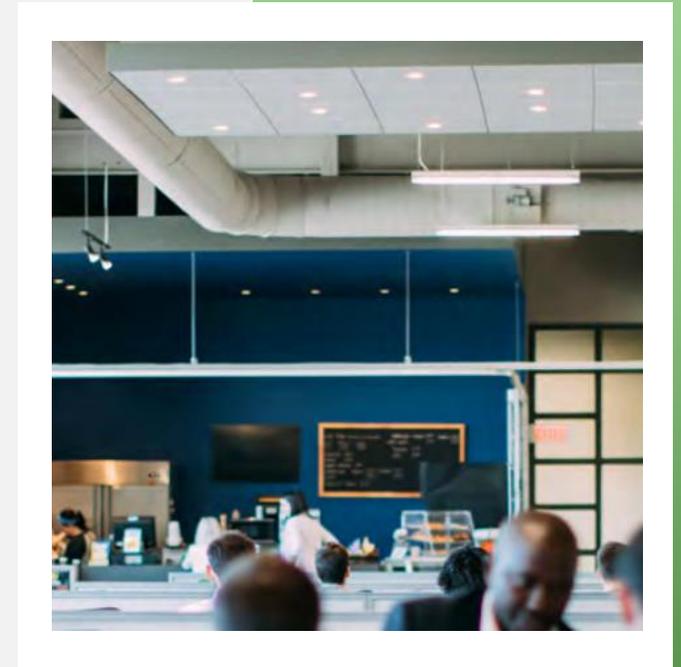


Lighting Power Density (LPD): Market Context

What is LPD? Maximum allowed lighting power in buildings.

Technology Shift:

- Lighting efficiency has improved dramatically over the past 15 years
- Older technologies (fluorescent, metal halide, incandescent) largely replaced
- High-quality, dimmable LED lighting is now standard
- LED performance continues to improve



Lighting Efficacy Has Improved 15%+ Since 2022 T-24

Luminaire Description	Average 2028 Efficacy (lm/W)	Average 2022 Efficacy (lm/W)	Ratio 2028 Efficacy to 2022 Efficacy
Cove light asymmetric 80CRI	117	91	128%
Cove light asymmetric 90CRI	117	N/A - new	128%
Downlight large 6"+ 80CRI	97	82	118%
Downlight large 6"+ 90CRI	92	78	117%
Downlight 4" and less 80CRI	100	76	132%
Downlight 4" and less 90CRI	94	83	113%
High Bay 80CRI	153	128	119%
Low bay 80CRI	152	145	105%
Pendant bowl direct/indirect 80CRI	107	81	131%
Pendant direct/indirect 80CRI	126	97	130%
Parking garage luminaire 80CRI	139	104	134%
Linear light slot 4" or more 80CRI	115	104	110%
Linear light slot 4" or less 80CRI	123	94	131%
Industrial strip 80CRI	141	135	105%
Troffer Basket 80CRI	132	116	114%
Troffer Basket 90CRI	125	101	124%
Troffer Lensed 80CRI	125	110	114%

Background Information

LPD Updates Across Code Title 24, Part 6 Cycles

2019 Code Cycle

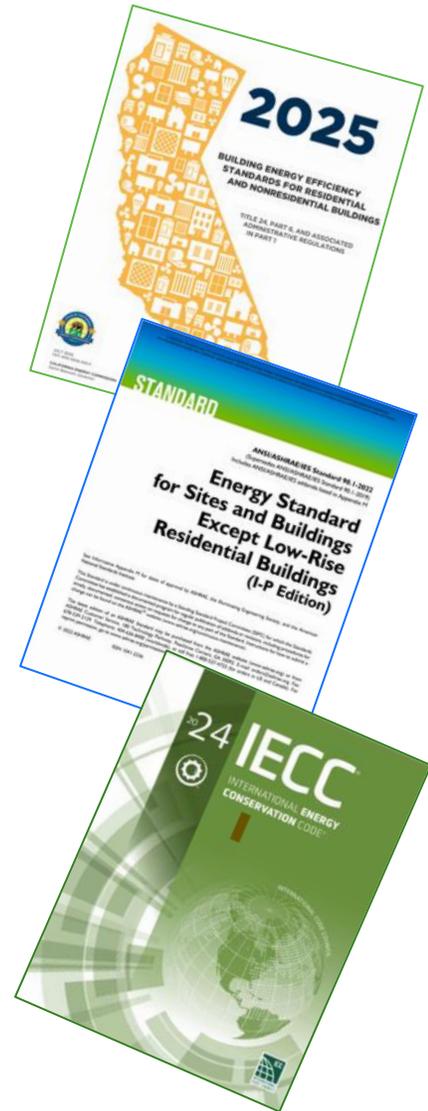
- Significant LPD reductions
- Transitioned to LED baseline assumptions

2022 Code Cycle

- Moderate LPD reductions
- Reflected improvements in LED efficiency

2025 Code Cycle

- No additional LPD reductions
- Tailored Method merged into Area Category Method (5 applications)



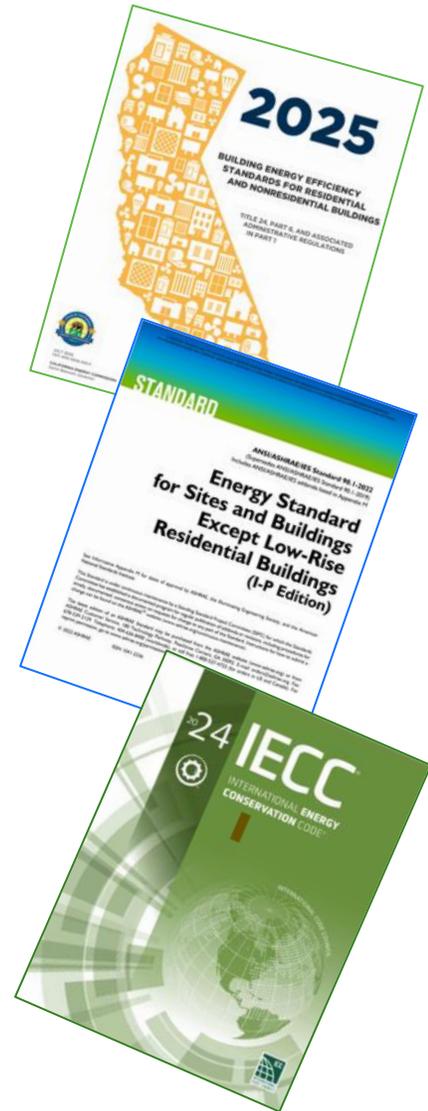
Background Information, cont

Since 2022, the national standards (ASHRAE/IES 90.1) and other model codes (IECC) have updated LPD values

ASHRAE 90.1/IES 90.1 (Addendum s to ASHRAE 90.1-2022)

- ~2% average increase in luminaire efficacy
- Lamp Lumen Depreciation (LLD) adjusted from 0.85 → 0.90
- Revised Luminaire Dirt Depreciation (LDD)
 - Updated using IES RP-36 methodology
 - Assumes 5-year cleaning cycle
 - Accounts for space type and luminaire type

2027 IECC has adopted ASHRAE 90.1 values



National Codes Require Lower LPD in Many Occupancies

2025 Title 24 Area Category	2025 Title 24	ASHRAE 90.1 2025	Percent Difference
Audience/Seating Area	0.50	0.23	54%
Concourse and Atria Area vs 90.1 Atria	0.60	0.29 – 0.49	18% - 54%
Concourse and Atria Area vs 90.1 Airport Concourse	0.60	0.46	23%
Convention... Area vs 90.1 Convention Exhibit	0.75	0.46	39%
Financial Transaction Area	0.71	0.53	25%
Hair Care, Beauty Salon	0.71	0.61	14%
Lounge, Breakroom, or Waiting Area	0.55	0.50	9%
Parking Garage Area: Parking Zone and Ramps	0.10	0.08	20%
Office Area: > 250 ft ²	0.60	0.52	13%
Religious Worship Area	0.95	0.64	33%

- Luminaire efficacy has improved
- ASHRAE 90.1-2025 is more stringent in certain spaces — an indication of industry acceptance
- 2027 IECC has adopted ASHRAE 90.1 values

Lighting Power Density



Proposed Code Change

- Update the prescriptive requirements for **allowed LPD** for nonresidential indoor spaces
 - New or modified space types and building types to reflect design patterns and market data (e.g., data centers)
 - Revisit data moved over from tailored lighting into area category (all can be simplified, similar to national codes)
 - Updates related to IES recommended practice, product updates, luminaire efficacy, and light loss factors
- Applies to new construction, additions, and alterations of nonresidential buildings
 - **Does not impact Group R Occupancies and associated Common or Public Use areas**

Process of Developing Proposed LPDs



Technical Model

Modeled prototype spaces to IES light levels



Market Validation

Industry interviews + expert input



Compliance Data

Review of reported LPDs in Title 24 databases

LPD & Energy Cost Savings Methodology

Methodology

- Inverse Lumen Method
- Same approach used in 2019 and 2022 CASE Reports

Key Model Inputs

- Target light levels (general, task, supplemental, wall wash)
- Space geometry
- Surface reflectance
- Cleanliness assumptions
- Luminaire characteristics:
 - Efficacy
 - Distribution
 - Light loss factors



Welcome to the IES Illuminance Selector



LPD & Energy Cost Savings Methodology, cont

Model Validation

- Compared against real project designs
- Cross-checked with industry design experience

Key Updates

- Revised Lamp Lumen Depreciation (LLD)
- **Higher efficacy, newer luminaires**

Energy Impact Calculation

Annual Energy Use

$LPD \times Area \times Full\ Load\ Operating\ Hours$

Full Load Operating hours from ACM schedules (by area category)

Energy Cost Savings

$Lighting\ Power \times Operating\ Hours \times Life\ Cycle\ Cost\ (\$/kWh)$

2022 Basket Troffer Luminaire
Luminous Efficacy = **116 lm/W**



2028 Basket Troffer Luminaire
Luminous Efficacy = **132 lm/W**



Results of Designer Interviews

- **Compliance can be complex:** Challenging on high-end or complicated projects; often requires extra allowances and adjustments.
- **Typical design assumptions:** LLD ≈ 0.90 ; LLF ≈ 0.85 – 0.80 .
- **Performance data trust:** Mixed confidence in cut sheet data versus real-world performance.
- **Multi-wattage approach:** Highest wattage usually acceptable; use fixed-output fixtures or current limiters if compliance is tight.
- **Retrofit choices:** UL Type B and UL Type C are the most common; UL Type A is mostly used for maintenance, with reliability and safety concerns.
- **Field verification:** Plan changes can affect compliance; on-site checks are important.

Results of Manufacturer Interviews

- **All UL Types supported:** UL Type A, B, C, and hybrids offered by key manufacturers.
- **Performance varies by system:** Two stakeholders indicated that ballast age and configuration affect actual power for UL Type A.
- **Multi-wattage preference:** Rate at highest wattage to keep fixtures reusable and reduce waste; avoid break-off tabs/DIP switches.
- **Labeling is a challenge:** Mixed views on lamp vs. luminaire labels; labels are often missed or discarded in the field.
- **Verification needed:** Support for checks at plan review and inspection to prevent higher-wattage swaps (substitutions).
- **Field realities:** Labor costs vary; UL Type A has maintenance/driver life issues, UL Type C preferred for long life but can also fail early.

Proposed Title 24 LPDs Compared to 2025 Title 24 & ASHRAE 90.1-2025

Primary Function Areas	2028 Allowed Proposed Base LPD (W/sf)	2028 Additional Lighting Power (W/sf)	2025 Allowed General LPD (W/sf)	Ratio Base 2028/2025 T-24	ASHRAE 90.1-2025 General Lighting	Ratio Base Allowance 2028 T-24/90.1-25
Ageing Eye/Low-vision: Corridor Area	0.60	0.30	0.70	86%	0.60	100%
Ageing Eye/Low-vision: Dining	0.80	0.40	0.80	100%	1.08	74%
Ageing Eye/Low-vision: Main Entry Lobby	0.80	1.10	0.85	94%	1.27	63%
Ageing Eye/Low-vision: Lounge/Waiting Area	0.80	0.40	0.80	100%	1.06	75%
Ageing Eye/Low-vision: Multipurpose Room	0.80	0.40	0.85	94%	1.06	75%
Ageing Eye/Low-vision: Religious Worship Area	0.80	0.50	1.00	80%	0.62	129%
Ageing Eye/Low-vision: Restroom	0.90	0.30	1.00	90%	0.90	100%
Ageing Eye/Low-vision: Stairwell	0.80	0.30	0.80	100%	N/A	N/A
Atria < 20 ft tall	0.30	0.20	0.60	50%	0.29	103%
Atria 20 to < 40 ft	0.40	0.25	0.60	67%	0.37	108%
Atria > 40 ft	0.50	0.30	0.60	83%	0.49	102%

Proposed Title 24 LPDs Compared to 2025 Title 24 & ASHRAE 90.1-2025, cont

Primary Function Areas	2028 Allowed Proposed Base LPD (W/sf)	2028 Addi-tional Lighting Power (W/sf)	2025 Allowed General LPD (W/sf)	Ratio Base 2028/ 2025 T-24	ASHRAE 90.1-2025 General Lighting	Ratio Base Allowance 2028 T-24/90.1-25
Audience Seating Area	0.3	0.35	0.5	60%	0.23	130%
Auditorium Area	0.5	0.45	0.7	71%	0.56	89%
Auto Repair / Maintenance Area	0.55	0.2	0.55	100%	0.56	98%
Barber, Beauty Salon and Spa Area	0.65	0.5	0.7	93%	0.61	107%
Civic Meeting Room	0.7	0.3	0.9	78%	0.96	73%
Convention Center: Ballroom	0.45	0.4	0.75	60%	N/A	N/A
Convention: Concourse	0.45	0.25	0.6	75%	0.51	88%
Convention: Exhibit Space	0.45	0.3	0.75	60%	0.83	54%
Convention: Meeting Room	0.65	0.25	0.75	87%	0.83	78%

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Control room	0.60	0	N/A	N/A	0.65	92%
Copy Room	0.45	0	0.50	90%	0.52	87%
Corridor Area	0.35	0.30	0.40	88%	0.43	81%
Data center: Computer room	0.45	0.25	N/A	N/A	0.7	64%
Dining Area: Bar/Lounge and Fine Dining	0.30	0.45	0.45	67%	0.69	43%
Dining Area: Cafeteria/Fast Food	0.40	0.25	0.45	89%	0.35	114%
Dining Area: Family and Leisure	0.35	0.25	0.40	88%	0.5	70%
Kitchen/Food Preparation Area	0.85	0	0.95	89%	0.93	91%
Education/Business: Classroom, Training,	0.56	7 W/lin ft	0.60	93%	0.68	82%
Educational, civic: Multipurpose room (art, music etc)	0.65	0.30	0.75	87%	0.83	78%

Proposed Title 24 LPDs Compared to 2025 Title 24 & ASHRAE 90.1-2025

Primary Function Areas	2028 Allowed Proposed Base LPD (W/sf)	2028 Addi-tional Lighting Power (W/sf)	2025 Allowed General LPD (W/sf)	Ratio Base 2028/ 2025 T-24	ASHRAE 90.1-2025 General Lighting	Ratio Base Allowance 2028 T-24/90.1-25
Electrical, Mechanical, Telephone Rooms	0.4	0.2	0.4	100%	0.67	60%
Exercise/Fitness Center and Gymnasium Area	0.55	0	0.5	110%	0.78	71%
Financial Transaction Area	0.53	0.3	0.7	76%	0.53	100%
Healthcare: Corridor	0.55	0.25	N/A	N/A	0.6	92%
Healthcare: Exam/Treatment Room	1.1	0	1.15	96%	1.26	87%
Healthcare: Imaging Room	0.55	0.35	0.6	92%	0.88	63%
Healthcare: Medical Supply Room	0.5	0	0.55	91%	0.52	96%
Healthcare: Nursery	0.8	0.2	0.8	100%	0.84	95%
Healthcare: Nurse's Station	0.8	0.3	0.85	94%	0.93	86%
Healthcare: Operating Room	1.8	0	1.9	95%	1.99	90%
Healthcare: Patient Room - Critical care	0.9	0.35	N/A			
Healthcare: Patient Room - General	0.65	0.35	0.7	93%	0.73	89%
Healthcare: Physical Therapy Room	0.65	0.1	0.75	86%	0.86	75%
Healthcare: Recovery Room	0.85	0.2	0.9	94%	1.13	75%

Proposed Title 24 LPDs Compared to 2025 Title 24 & ASHRAE 90.1-2025

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Laboratory: Scientific and Teaching	0.8	0.35	0.9	89%	1.18	68%
Laundry Area	0.43	0	0.45	96%	0.48	90%
Library : Reading Area	0.7	0.25	0.8	88%	0.8	88%
Library : Stacks Area	0.91	0	1.0	91%	1.15	79%
Lobby: Elevator	0.5	0.4	N/A	N/A	0.56	89%
Lobby: Main entry	0.6	0.4	0.7	86%	0.74	81%
Lobby: Performing Arts	0.6	0.4	0.7	86%	1.13	53%
Locker Room	0.4	0	0.45	88%	0.4	99%
Lounge, Breakroom, or Waiting Area	0.45	0.25	0.55	82%	0.5	90%

Proposed Title 24 LPDs Compared to 2025 Title 24 & ASHRAE 90.1-2025

Primary Function Areas	2028 Allowed Proposed Base LPD (W/sf)	2028 Additional Lighting Power (W/sf)	2025 Allowed General LPD (W/sf)	Ratio Base 2028/2025 T-24	ASHRAE 90.1-2025 General Lighting	Ratio Base Allowance 2028 T-24/90.1-25
Manufacturing & Commercial Work Area: Low Bay	0.63	0.2	0.6	105%	0.81	77%
Manufacturing & Commercial Work Area: High Bay	0.65	0.2	0.65	100%	1.15	57%
Manufacturing & Commercial Work Area: Precision	0.8	0.7	0.85	94%	0.71	113%
Motion picture: Theater area	0.32	0.25	0.5	65%	0.2	162%
Museum: Exhibition/Display	0.6	0.5	0.8	75%	0.27	222%
Museum Area: Restoration Room	0.65	0.35	0.7	93%	1.17	56%
Office Area: ≤ 250 square feet	0.55	0.25	0.65	84%	0.69	79%
Office Area: > 250 square feet	0.5	0.25	0.6	83%	0.52	96%
Office: Conference Room	0.6	0.25	0.75	80%	0.83	72%

Proposed Title 24 LPDs Compared to 2025 Title 24 & ASHRAE 90.1-2025

Primary Function Areas	2028 Allowed Proposed Base LPD (W/sf)	2028 Addi-tional Lighting Power (W/sf)	2025 Allowed General LPD (W/sf)	Ratio Base 2028/2025 T-24	ASHRAE 90.1-2025 General Lighting	Ratio Base Allowance 2028 T-24/90.1-25
Parking Garage Area: Parking Zone and Ramps	0.08	0	0.1	80%	0.08	100%
Parking Garage Area: Daylight Adaptation Zones	0.08	0.7	1	8%	0.79	10%
Performance : Theater area	0.5	0.4	0.8	63%	0.97	52%
Performance : Dressing room	0.47		N/A	N/A	0.37	126%
Pharmacy Area	1	0.35	1	100%	1.49	67%
Retail: Concourse	0.35	0.35	0.6	58%	0.51	69%
Retail: Grocery Sales	0.85	0.35	1	85%	0.79	108%
Retail: Merchandise Sales	0.91	0.35	0.95	95%	0.79	115%
Retail: Fitting Room	0.5		0.6	83%	0.42	119%
Religious Worship Area	0.75	0.25	0.95	79%	0.64	117%
Restrooms	0.6	0.35	0.65	92%	0.73	82%
Stairwell	0.57	0.35	0.6	95%	0.44	130%

Proposed Title 24 LPDs Compared to 2025 Title 24 & ASHRAE 90.1-2025

Primary Function Areas	2028 Proposed Allowed Base LPD (W/sf)	2028 Addi-tional Lighting Power (W/sf)	2025 Allowed General LPD (W/sf)	Ratio Base 2028/ 2025 T-24	ASHRAE 90.1-2025 General Lighting	Ratio Base Allowance 2028 T-24/90.1-25
Sports Arena – Playing Area: Class I Facility	2.25	0	2.25	100%	2.65	85%
Sports Arena – Playing Area: Class II Facility	1.45	0	1.45	100%	1.87	78%
Sports Arena – Playing Area: Class III Facility	1.05	0	1.1	95%	1.21	86%
Sports Arena – Playing Area: Class IV Facility	0.71	0	0.75	95%	0.81	88%
Transportation: Baggage Area	0.3	0.1	0.4	75%	0.29	103%
Transportation: Concourse	0.35	0.35	0.6	58%	0.46	76%
Transportation : Ticketing Area	0.4	0.2	0.45	89%	0.37	108%
Transportation: Waiting area	0.45	0.2	0.6	75%	0.71	63%
Videoconferencing Studio	0.73	1	0.9	81%	1.11	66%
Warehouse: Storage	0.4	0	0.4	100%	0.41	98%
Warehouse: Shipping and Handling	0.6	0	0.6	100%	0.83	72%

Poll

Which applications have LPDs that seem too low?

(Open ended question – please write down space types that would be most difficult to meet new LPDs)

Poll

Which applications have LPDs that seem too high?

(Open ended question – please write down space types where the 2028 proposal contains overly high LPD limits)

Base lighting system methodology

- Cost-effectiveness calculated for the base lighting system in sample designs
- Base lighting system a combination of general lighting, task lighting and supplemental lighting
 - This does not include ornamental and display lighting
- The 2022 original base lighting system wattage, energy consumption, life cycle energy cost and equipment cost is compared to the 2028 proposed base lighting system
- The 2022 design contains comparable luminaires to that in the 2028 design but with different efficacies (see slide 4)
- Luminaire costs are collected for luminaire models that approximate the average efficacies used in the model for developing the 2022 Title 24, part 6 standards
- Similarly, luminaire costs are collected for luminaires with average efficacies found currently for each luminaire type that we are using for developing the 2028 Title 24, part 6 standards
- Outliers (very high or very low) costs are kicked out and then costs averaged for each luminaire type by target efficacy

Luminaire Costing – with 2022 and 2028 Efficacies

Type	Representative Year Luminaire Type	Size	Avg Watts	Avg Lumens	Avg Efficacy (Lm/W)	Avg Luminaire Cost (\$)	Cost per Watt (\$/W)
Basket Troffer	2022 - Basket Troffer	2X2	32	3,523	110	\$305.54	\$9.49
Basket Troffer	2028 - Basket Troffer	2X2	26	3,374	130	\$146.06	\$5.62
Basket Troffer	2022 - Basket Troffer	2X4	63	6,897	110	\$329.44	\$5.26
Basket Troffer	2028 - Basket Troffer	2X4	49	6,638	135	\$127.42	\$2.58
Lensed panel troffers	2022 - Lensed panel troffers	2X2	31	3,487	114	\$51.31	\$1.67
Lensed panel troffers	2028 - Lensed panel troffers	2X2	29	3,608	125	\$65.00	\$2.24
Lensed panel troffers	2022 - Lensed panel troffers	2X4	54	5,864	108	\$89.86	\$1.65
Lensed panel troffers	2028 - Lensed panel troffers	2X4	53	6,890	129	\$105.67	\$1.98
Linear Light Slots	2022 - Linear Light Slots	4-inch	23	2,233	94	\$340.44	\$14.59
Linear Light Slots	2028 - Linear Light Slots	4-inch	14	1,679	123	\$391.88	\$28.81
Linear Light Slots	2022 - Linear Light Slots	6-inch	36	4,004	110	\$421.21	\$11.58
Linear Light Slots	2028 - Linear Light Slots	6-inch	50	5,803	116	\$401.25	\$7.99
Linear Cove Lights	2022 - Linear Cove Lights	4-ft Section	39	4,124	105	\$676.25	\$17.34
Linear Cove Lights	2028 - Linear Cove Lights	4-ft Section	26	3,075	118	\$381.96	\$14.69
Linear Indirect/Direct Pendants	2022 - Linear Indirect/Direct Pendants	4-ft Section	49	5,665	116	\$506.05	\$10.32
Linear Indirect/Direct Pendants	2028 - Linear Indirect/Direct Pendants	4-ft Section	26	3,429	131	\$550.00	\$20.99
Indirect/Direct Pendant Bowl Luminaire	2022 - Indirect/Direct Pendant Bowl Luminaire	36" to 60" dia.	140	11,705	85	\$3,488.75	\$24.92
Indirect/Direct Pendant Bowl Luminaire	2028 - Indirect/Direct Pendant Bowl Luminaire	36" to 60" dia.	131	16,370	122	\$4,715.13	\$36.13

Luminaire Costing (continued)

Type	Representative Year Luminaire Type	Size	Avg Watts	Avg Lumens	Avg Efficacy (Lm/W)	Avg Luminaire Cost (\$)	Cost per Watt (\$/W)
Downlight	2022 - Downlight	4-inch (low)	22	1,622	75	\$239.75	\$11.12
Downlight	2028 - Downlight	4-inch (low)	25	2,520	98	\$228.60	\$9.02
Downlight	2022 - Downlight	4-inch (med)	32	2,458	77	\$249.75	\$7.81
Downlight	2028 - Downlight	4-inch (med)	27	2,706	100	\$231.90	\$8.59
Downlight	2022 - Downlight	6-inch (med)	15	1,238	81	\$200.92	\$13.22
Downlight	2028 - Downlight	6-inch (med)	35	3,235	94	\$285.94	\$8.16
Downlight	2022 - Downlight	6-inch (high)	54	4,785	89	\$161.44	\$2.97
Downlight	2028 - Downlight	6-inch (high)	56	5,836	104	\$244.56	\$4.34
Under counter strip	2022 - Under counter strip	4ft Standard	17	1,224	73	\$168.98	\$10.12
Under counter strip	2028 - Under counter strip	4ft Standard	15	1,671	109	\$221.49	\$14.48
Under counter strip	2022 - Under counter strip	4ft High Output	29	2,856	100	\$310.50	\$10.82
Under counter strip	2028 - Under counter strip	4ft High Output	20	2,308	113	\$258.52	\$12.67
Low bay	2022 - Low bay		88	12,870	146	\$276.38	\$3.14
Low bay	2028 - Low bay		101	15,353	151	\$251.83	\$2.49
High Bay	2022 - High Bay		242	35,600	147	\$161.75	\$0.67
High Bay	2028 - High Bay		220	33,059	151	\$178.03	\$0.81

Luminaire Costing (continued)

Representative Year Luminaire Type	Size	Avg Watts	Avg Lumens	Avg Efficacy (Lm/W)	Avg Luminaire Cost (\$)	Cost per Watt (\$/W)
2022 - Strip Luminaires	Low output 4ft	41	4,458	114	\$218.27	\$5.37
2028 - Strip Luminaires	Low output 4ft	32	4,678	148	\$164.65	\$5.23
2022 - Strip Luminaires	High output 8ft	107	12,582	119	\$274.63	\$2.57
2028 - Strip Luminaires	High output 8ft	76	11,047	146	\$240.97	\$3.17
2022 - Parking garage	Low output	32	3,454	111	\$585.35	\$18.58
2028 - Parking garage	Low output	31	4,222	136	\$484.06	\$15.61
2022 - Parking garage	High Output	62	6,866	112	\$632.57	\$10.20
2028 - Parking garage	High Output	54	7,406	137	\$519.90	\$9.63

Poll

If you specify luminaires and evaluate bid pricing how common is it that the more efficacious luminaires cost less?

(Select one)

- Frequently
- Occasionally
- Rarely
- I don't evaluate bid pricing

Poll

If you specify luminaires and evaluate bid pricing do you feel the prices shown here are in the right ballpark?

(Select one)

- Prices seem high
- Prices seem low
- The trends seem to be approximately right
- I don't evaluate bid pricing

Base lighting system cost-effectiveness

Benefits are based on 30-year Long-term System Cost (LSC)

- Life cycle **operating costs** of **2022 system lighting design** minus operating costs of **proposed 2028 lighting system design**

Incremental cost is calculated by subtracting the 2028 system cost from the 2022 system cost

- **2022 Title 24 standard moderate efficacy** LED lighting system (average efficacy 6 years ago)
- **2028 Title 24 standard higher efficacy** LED lighting system (average efficacy now)
- In many cases **the incremental cost is negative**
- The more efficacious luminaires are often **cheaper in terms of \$/Watt**
- Additionally the **2028 designs use less watts**

If system **saves energy** and has **negative incremental cost**, simple payback is immediate and **B/C ratio is infinite** (all benefits and no net costs)

Cost-effectiveness

Primary Function Areas	Wattage Reduction (W)	30 Year PV Savings LSC (2029 PV\$)	Incremental Cost Including Replacements (\$)	B/C ratio
Atria < 20 ft tall (used to be atria concourse)	427	\$10,911	\$849	12.85
Atria 20 to < 40 ft (used to be atria concourse)	450	\$11,505	\$7,479	1.54
Atria > 40 ft (used to be atria concourse)	-481	-\$12,294	\$25,466	Increased Energy
Audience Seating Area	141	\$3,805	-\$688	Infinite
Auditorium Area	875	\$23,677	-\$4,282	Infinite
Auto Repair / Maintenance Area	1,355	\$27,476	-\$10,920	Infinite
Barber, Beauty Salon and Spa Area	343	\$8,773	-\$4,464	Infinite
Civic Meeting Room	37	\$1,014	-\$780	Infinite
Convention Center: Ballroom (used to be multipurpose)	462	\$12,498	-\$4,575	Infinite
Convention: Concourse (used to be atria concourse)	25	\$668	\$2,008	0.33
Convention: Exhibit Space (used to be multipurpose)	2,417	\$65,377	-\$13,996	Infinite
Convention: Meeting Room (used to be multipurpose)	-92	-\$2,478	\$2,019	Increased Energy
Control room (new)	37	\$748	\$1,540	0.49
Copy Room	-6	-\$108	\$143	Increased Energy
Corridor Area	-9	-\$155	\$161	Increased Energy

Primary Function Areas	Wattage Reduction (W)	30 Year PV Savings LSC (2029 PV\$)	Incremental Cost Including Replacements (\$)	B/C ratio
Data center: Computer room (new)		\$0	\$2,736	0.00
Dining Area: Bar/Lounge and Fine Dining	317	\$12,426	-\$7,845	Infinite
Dining Area: Cafeteria/Fast Food	87	\$3,422	-\$1,816	Infinite
Dining Area: Family and Leisure	63	\$2,462	-\$1,571	Infinite
Kitchen/Food Preparation Area	39	\$1,523	-\$146	Infinite
Education/Business: Classroom, Training,	29	\$466	-\$414	Infinite
Educational, civic: Multipurpose room (art, music etc)	125	\$1,991	-\$2,419	Infinite
Electrical, Mechanical, Telephone Rooms	35	\$419	-\$186	Infinite

Cost-effectiveness (cont)

Primary Function Areas	Wattage Reduction (W)	30 Year PV Savings LSC (2029 PV\$)	Incremental Cost Including Replacements (\$)	B/C ratio
Exercise/Fitness Center and Gymnasium Area	-187	-\$4,791	\$513	Increased Energy
Financial Transaction Area	81	\$1,378	-\$1,446	Infinite
Healthcare: Corridor (new)		\$0	\$9,846	0.00
Healthcare: Exam/Treatment Room	24	\$519	-\$434	Infinite
Healthcare: Imaging Room	14	\$308	-\$279	Infinite
Healthcare: Medical Supply Room	108	\$2,325	-\$1,634	Infinite
Healthcare: Nursery	-20	-\$422	\$175	Increased Energy
Healthcare: Nurse's Station	18	\$380	-\$253	Infinite
Healthcare: Operating Room	319	\$6,895	-\$4,846	Infinite
Healthcare: Patient Room - Critical care (new)		\$0	\$436	0.00
Healthcare: Patient Room - General	44	\$957	-\$771	Infinite
Healthcare: Physical Therapy Room	59	\$1,279	-\$1,075	Infinite
Healthcare: Recovery Room	49	\$1,050	-\$668	Infinite

Primary Function Areas	Wattage Reduction (W)	30 Year PV Savings LSC (2029 PV\$)	Incremental Cost Including Replacements (\$)	B/C ratio
Laboratory: Scientific and Teaching	41	\$1,190	-\$145	Infinite
Laundry Area	-26	-\$660	\$406	Increased Energy
Library : Reading Area	58	\$996	-\$848	Infinite
Library : Stacks Area	40	\$687	-\$714	Infinite
Lobby: Elevator	33	\$889	-\$866	Infinite
Lobby: Main entry	166	\$4,483	-\$2,690	Infinite
Lobby: Performing Arts	156	\$4,227	-\$1,218	Infinite
Locker Room	17	\$431	-\$47	Infinite
Lounge, Breakroom, or Waiting Area	17	\$458	-\$289	Infinite
Manufacturing & Commercial Work Area: Low Bay	137	\$2,768	-\$966	Infinite
Manufacturing & Commercial Work Area: High Bay	828	\$16,795	-\$6,650	Infinite
Manufacturing & Commercial Work Area: Precision	749	\$15,183	-\$3,808	Infinite

Cost-effectiveness (cont)

Primary Function Areas	Wattage Reduction (W)	30 Year PV Savings LSC (2029 PV\$)	Incremental Cost Including Replacements (\$)	B/C ratio
Motion picture: Theater area	215	\$5,828	-\$3,233	Infinite
Museum: Exhibition/Display	-22	-\$602	\$286	Increased Energy
Museum Area: Restoration Room	334	\$9,028	-\$5,063	Infinite
Office Area: ≤ 250 square feet	10	\$174	-\$192	Infinite
Office Area: > 250 square feet	46	\$784	-\$668	Infinite
Office: Conference Room	70	\$1,198	-\$1,094	Infinite
Parking Garage Area: Parking Zone and Ramps	105	\$5,949	-\$5,776	Infinite
Parking Garage Area: Daylight Adaptation Zones ⁸	176	\$9,970	-\$5,315	Infinite

Primary Function Areas	Wattage Reduction (W)	30 Year PV Savings LSC (2029 PV\$)	Incremental Cost Including Replacements (\$)	B/C ratio
Performance : Theater area	1,727	\$46,707	-\$22,186	Infinite
Performance : Dressing room	5	\$135	-\$64	Infinite
Pharmacy Area	54	\$1,378	-\$623	Infinite
Retail: Concourse	297	\$7,601	-\$3,682	Infinite
Retail: Grocery Sales	715	\$18,283	-\$15,597	Infinite
Retail: Merchandise Sales	146	\$3,735	-\$1,188	Infinite
Retail: Fitting Room	10	\$245	-\$124	Infinite
Religious Worship Area	1,486	\$40,201	-\$9,168	Infinite
Restrooms	-63	-\$1,070	\$1,452	Increased Energy

Complete Building LPD Analysis

TYPE OF BUILDING	Complete Building 2025 T-24	Proposed Complete Building 2028 T-24	Ratio 2028 T-24 Complete Bld/ 2025 T-24 Completed Bld	ASHRAE 90.1-2025 Addendum AN (BAM)	Ratio 2028 Proposed/ 90.1 BAM	Calculated Weighted Average Spaces 2028 T-24 Base	Ratio Proposed 2028/ 2028 Space Average
Assembly Building	0.65	0.55	85%	0.58	95%	0.44	124%
Bank or Financial Institution Building	0.65	0.55	85%	-	-	0.51	107%
Grocery Store Building	0.90	0.80	89%	0.73	110%	0.70	114%
Gymnasium Building	0.60	0.55	92%	0.70	79%	0.52	106%
Healthcare Facility (outpatient)	0.90	0.75	83%	0.74	101%	0.78	97%
Healthcare Facility (inpatient)	0.90	0.85	94%	0.88	97%	0.75	113%
Industrial/Manufacturing Facility Building	0.60	0.60	100%	0.77	78%	0.57	105%
Library Building	0.70	0.65	93%	0.81	80%	0.66	98%
Motion Picture Theater Building	0.60	0.55	92%	0.39	141%	0.55	99%
Museum Building	0.65	0.60	92%	0.52	115%	0.56	108%
Office Building	0.60	0.55	92%	0.59	93%	0.50	109%
Parking Garage Building	0.13	0.11	85%	0.14	79%	0.10	106%
Performing Arts Theater Building	0.75	0.65	87%	0.76	86%	0.50	129%
Religious Facility Building	0.70	0.65	93%	0.61	107%	0.64	101%
Restaurant Building	0.65	0.55	85%	0.33	168%	0.56	98%
Retail Store Building	0.90	0.80	89%	0.73	110%	0.75	107%
School Building	0.60	0.55	92%	0.66	83%	0.54	102%
Sports Arena Building	0.75	0.70	93%	0.68	103%	0.70	101%
Service Facility (including auto repair)		0.60		0.69	87%	0.55	110%

TABLE 140.6-B COMPLETE BUILDING METHOD LIGHTING POWER DENSITY VALUES

TYPE OF BUILDING	ALLOWED LIGHTING POWER DENSITY (WATTS PER SQUARE FOOT)
Assembly Building	0.65 <u>0.55</u>
Bank or Financial Institution Building	0.65 <u>0.55</u>
Grocery Store Building	0.90 <u>0.80</u>
Gymnasium Building	0.60 <u>0.55</u>
Healthcare Facility (outpatient)	0.90 <u>0.75</u>
Healthcare Facility (inpatient)	0.90 <u>0.85</u>
Industrial/Manufacturing Facility Building	0.60 _
Library Building	0.70 <u>0.65</u>
Motion Picture Theater Building	0.60 <u>0.55</u>
Museum Building	0.65 <u>0.60</u>
Office Building	0.60 <u>0.55</u>
Parking Garage Building	0.13 <u>0.11</u>
Performing Arts Theater Building	0.75 <u>0.65</u>
Religious Facility Building	0.70 <u>0.65</u>
Restaurant Building	0.65 <u>0.55</u>
Retail Store Building	0.90 <u>0.80</u>
School Building	0.60 <u>0.55</u>
Sports Arena Building	0.75 <u>0.70</u>
Service Facility (including auto repair)	<u>0.60</u>
All other buildings	0.40 _

Proposed Code Language

Complete Building Method

The complete building method building types are all nonresidential and thus are not affected by AB 130 restrictions on changes to this part of the standard:

Section 140.6 – Prescriptive Requirements for Indoor Lighting

(c) Calculation of allowed indoor lighting power: specific methodologies

1. Complete Building Method

TABLE 140.6-B COMPLETE BUILDING METHOD LIGHTING POWER DENSITY VALUES FOR NONRESIDENTIAL BUILDINGS NOT INCLUDING GROUP R OCCUPANCIES AND COMMON USE OR PUBLIC USE AREAS

Proposed Code Language

Area Category Method

Language to clarify group R occupancies will not be impacted by 2028 updates:

Section 140.6 – Prescriptive Requirements for Indoor Lighting

(c) Calculation of allowed indoor lighting power: specific methodologies

2. Area Category Method

LPD values in
Table 140.6-C1
are updated in
the 2028 cycle



TABLE 140.6-C₁ AREA CATEGORY METHOD - LIGHTING POWER DENSITY VALUES (WATTS/FT²) FOR NONRESIDENTIAL BUILDINGS NOT INCLUDING GROUP R OCCUPANCIES AND COMMON USE OR PUBLIC USE AREAS

LPD values in
Table 140.6-C2
will not change
for 2028 cycle



TABLE 140.6-C₂ AREA CATEGORY METHOD - LIGHTING POWER DENSITY VALUES (WATTS/FT²) FOR GROUP R OCCUPANCIES AND COMMON USE OR PUBLIC USE AREAS

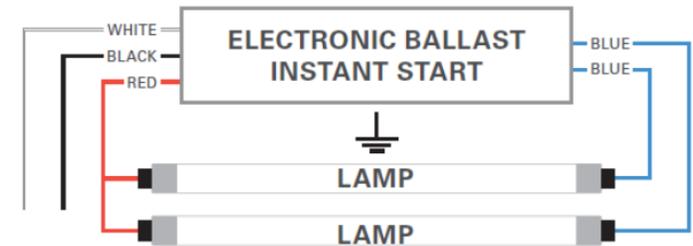
130.0(c) Luminaire Classification and Power



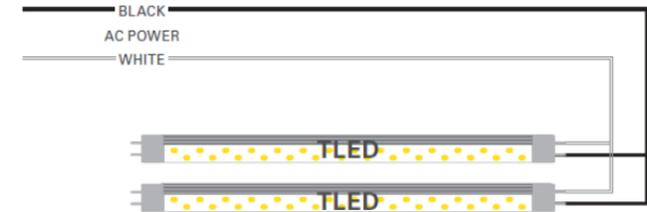
130.0(c) Luminaire Classification and Power

- Updated to reflect **current lighting technologies**
 - UL Type A
 - UL Type B
 - UL Type C
 - Variable wattage SSL lighting systems
- Simplified wattage determination rules
- Aligns compliance approach with market practice

UL Type A



UL Type B



UL Type C

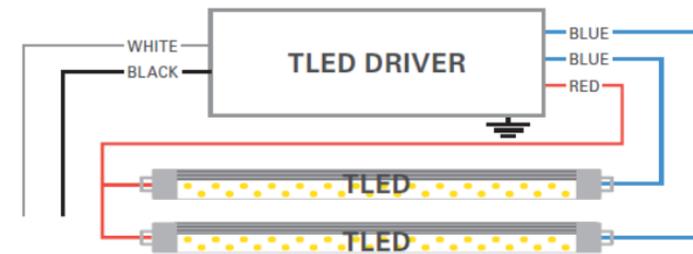


Photo Credit: UC Davis CLTC

Poll

In your experience, what LED product category is most commonly installed for retrofit applications?

(Select one)

- Linear LED Lamps - UL Type A
- Linear LED Lamps - UL Type B
- Linear LED Lamps - UL Type C
- Retrofit Kits (light source, driver, lens, reflectors)
- New Luminaires

Market Performance

UL Type	Number of Products	Avg Efficacy (lm/W)	% Delta vs. UL Type B
UL Type A	276	132.8	-13.0%
UL Type B	885	152.7	0% (baseline)
UL Type A/B	402	129.9	-14.9%
UL Type C	937	138.5	-9.3%

DesignLights Consortium, Linear LED Lamp Data

Key Findings

Ballast-dependent systems (Type A and A/B) show ~13–15% lower efficacy than direct-wire systems (Type B)

130.0(c) Luminaire Classification and Power

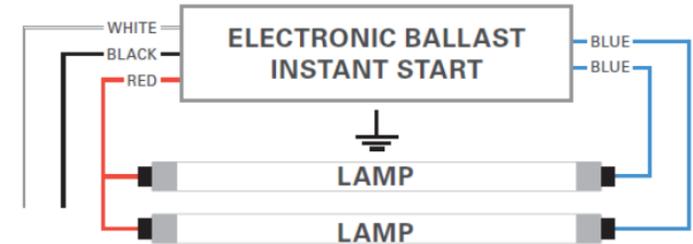
Ballast-Powered SSL (New for 2028)

Applies to:

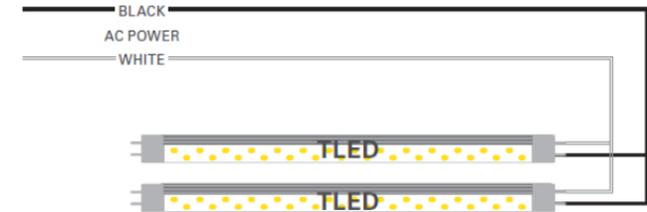
- Luminaires with ballasts powering SSL lighting (UL Type A)

Wattage = Maximum rated ballast wattage

UL Type A



UL Type B



UL Type C

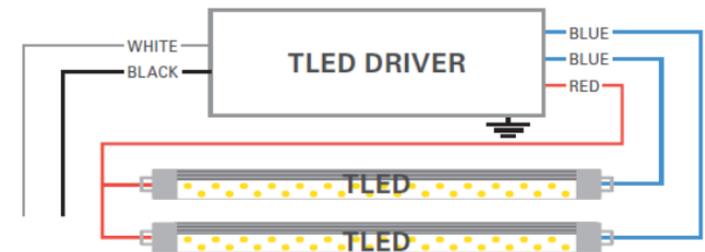


Photo Credit: UC Davis CLTC

130.0(c) Luminaire Classification and Power

130.0(c)2 – Line-Voltage Lamp Holders

Applies to:

- Luminaires with line-voltage lamp holders not served by drivers, ballasts, or transformers (UL Type B)

Wattage = Wattage of the installed lamps in luminaire

130.0(c)3 – Inseparable & Remote-Driver SSL

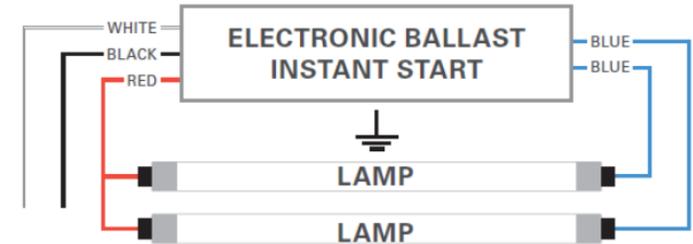
Applies to:

- Inseparable SSL luminaires & remote-driver SSL (UL Type C)

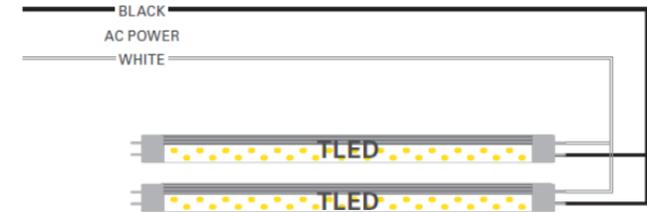
Wattage =

- **Fixed wattage:** Use labeled wattage
- **Variable wattage:** Use maximum field-adjustable wattage and label as such. (POLL)

UL Type A



UL Type B



UL Type C

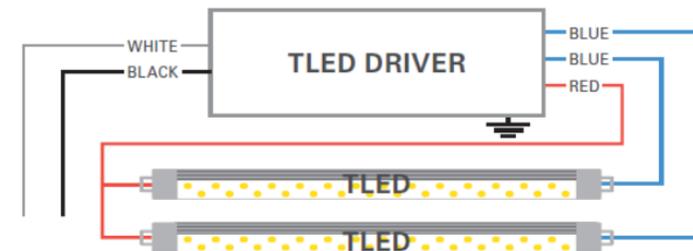


Photo Credit: UC Davis CLTC

Clarified Wattage Rules for UL Type A, B, and C – Proposed

UL Type A

Luminaires with ballasts powering SSL

Wattage = maximum rated ballast wattage

NOW: No credit for lower-wattage TLED, but with clear definitions.
(Previously no credit for TLED)

UL Type B

Line-voltage lamp holders not served by drivers, ballasts, or transformers

Wattage = combined wattage of lamps with self-contained drivers

NOW: Credit allowed for lower-wattage TLED
(Previously no credit for lower-wattage TLED)

UL Type C

Inseparable SSL or remote-driver SSL luminaires

Wattage = maximum rated driver + lamp combination

NO CHANGE: Credit allowed for lower-wattage TLED

Poll

What is your preferred method for verification of the maximum rated label wattage of variable output luminaires?

(Select one)

- A. Plans examiner verification of specification sheet as compared to NRCC reported wattage
- B. Field inspector verification of luminaire label after installation as compared to NRCI reported wattage
- C. Either A or B
- D. Both A and B
- E. Other

Simplification of Indoor Lighting Alteration Pathway

Simplify the one-to-one luminaire alteration pathway by replacing the **5,000 ft² floor-area limit** with a **3,000 W cap on altered luminaires**.

- Maintains comparable stringency
- Keeps simplified pathway limited to moderate retrofit projects (~100 fixtures)
- Eliminates need to calculate floor area or drawing a floor plan

Proposed Simplified Pathway

Applies where:

- Total altered luminaire wattage $\leq 3,000$ W
- Post-alteration wattage $\geq 40\%$ lower than pre-alteration
- Existing lighting control requirements for one-to-one alteration pathway still apply

What are your thoughts on the new language for lighting alterations?

(You may share support, concerns, or general comments.)

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More information on

[CEC's 2028 proceeding website.](#)

**We want to
hear from you!**