

Lighting Compliance

Lighting Requirements

You can use COMcheck-EZ™ to demonstrate that your commercial or high-rise residential building design complies with energy codes based on *ASHRAE Energy Code for Commercial and High-Rise Residential Buildings* [ASHRAE 90.1 ('89) Code].

This guide covers the energy code requirements for lighting systems and equipment. It includes necessary tables, worksheets, and instructions for demonstrating compliance using an entirely manual method. All you need is a pencil and copies of the *Lighting Compliance Certificate* and *Lighting Application Worksheet* at the end of this guide.

The COMcheck-EZ software provides an alternative compliance method to using this guide. The compliance calculation used in the software is identical to the manual version in this guide. The software simply automates the calculation of the lighting power allowance for the building and the connected load of the lighting systems you specify. It also generates a compliance report to submit with your building permit application. Refer to the *COMcheck-EZ Software Compliance Guide* for instructions on obtaining and using the software.

What the Energy Code Covers

To promote the use of energy-efficient lighting in commercial and high-rise residential buildings, the energy code requires

- manual or automatic controls or switches that allow occupants to dim lights and turn them on or off when appropriate. This guide identifies control, switching, and wiring requirements that apply to all buildings.
- total connected loads for indoor lighting systems that do not exceed power allowances for the building. This guide shows how to demonstrate compliance with interior-lighting power limits using the *Lighting Application Worksheet*.
- energy-efficient exterior lighting. This guide contains criteria for complying with exterior-lighting requirements.

Demonstrating Compliance

To demonstrate compliance,

- indicate on your project plans switching schemes, fixture types, and lamp/ballast types that comply.
- complete the *Lighting Application Worksheet* included with this guide to indicate compliance with indoor-lighting power limits.
- complete the *Lighting Compliance Certificate* included with this guide. Use the actual fixture wattages or, if actual fixture wattages are unavailable, typical wattages from the *Typical Lighting Wattage* table at the end of this guide.

Control, Switching, and Wiring Requirements

All lighting systems must have controls or switches that allow occupants to manually or automatically dim lights or turn them on or off.

Interior-Lighting Controls

Independent interior-lighting controls are required for each area enclosed by ceiling-height partitions. These controls can be any of the following:

- a switch located so the occupant can see the area controlled by the switch
- a switch that indicates whether the lights are on or off when it is impossible to see the controlled area from the switch location
- an occupant-sensing device.

Exceptions to this requirement are

- areas that must be continuously illuminated for building security or emergency exits. These areas must be designated as security or emergency exit areas on the plans, and the lights must be controlled by switches accessible only to authorized personnel.
- public areas, such as building lobbies and retail stores. These lights can be controlled by a single switch for the entire area.

Master Switches in Hotel and Motel Guest Rooms

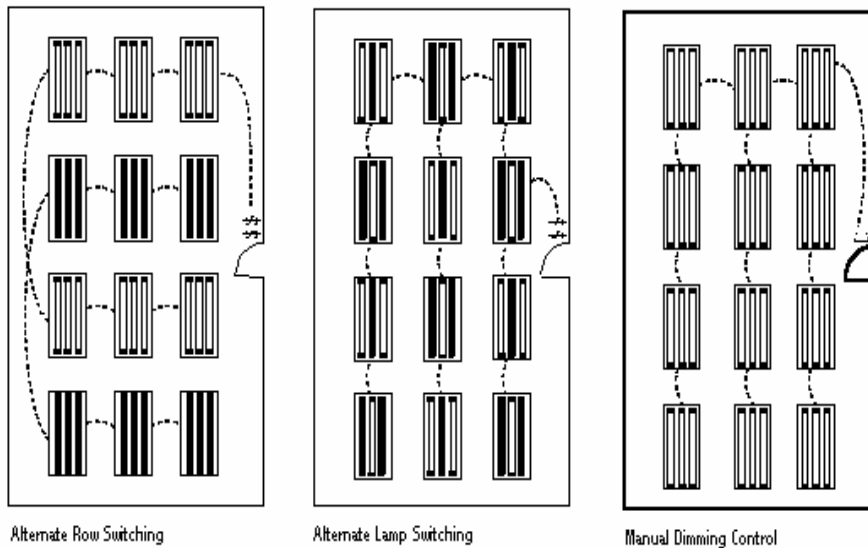
One or more master light switches are required at the entry door of hotel and motel guest rooms. Master switches operate all permanently wired luminaires and switched receptacles. These switches are usually three-way devices wired in combination with local controls. In multiple-room suites, a standard control device is required at the entrance to each separate room.

Bathroom lighting systems in hotel and motel guest rooms are exempt from these requirements.

Bi-Level Switching

Lighting within a space must be switched so the occupant can reduce the connected lighting load by at least 50% in a reasonably uniform illumination pattern. Bi-level switching requirements may be met by

- switching alternate luminaires in a row or alternate rows of luminaires
- separately switching half of the lamps in each luminaire or two lamps in three-lamp luminaires
- using dimming controls on all lamps or luminaires.



Bi-level switching is not required if

- the area has only one luminaire
- an occupant-sensing device controls the area
- the area is a corridor, storage area, restroom, or lobby.

Exterior Lighting Controls

Automatic controls are required for all exterior lights. The control may be a directional photocell, an astronomical time switch, or a building automation system with astronomical time switch capabilities. The control must automatically turn off exterior lighting when daylight is available. Lights in parking garages, tunnels, and other large-covered areas that must be on during daylight hours are exempt from this requirement.

Tandem Wiring

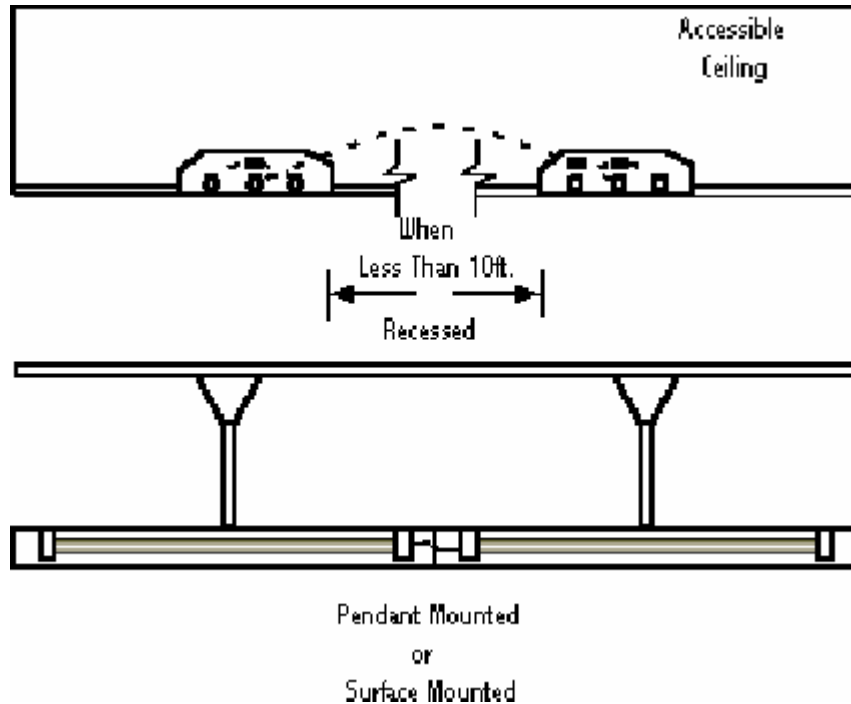
A two-lamp ballast is the most efficient conventional ballast type. The following types of one-lamp or three-lamp fluorescent fixtures must be tandem-wired:

- pendant- or surface-mounted luminaires in continuous rows

- recess-mounted luminaires located within 10 ft of each other and served by the same switch.

Exempted from this requirement are

- luminaires that use electronic high-frequency ballasts
- luminaires that are not on the same switch control or in the same area.



Tandem Wiring

Interior Lighting Requirements

Interior lighting must not exceed allowed power limits. Interior lighting includes all permanently installed general and task lighting shown on the plans.

It does not include lighting used for theatrical, stage, or broadcasting productions; specialized lighting for medical, dental, and research purposes; display lighting for exhibits in galleries, museums, and monuments; lighting for indoor plant growth; emergency lighting that is normally off; lighting in high-risk security areas; lighting in areas designed primarily for the physically impaired or aged, or lighting in dwelling units.

To determine if your project complies with the interior-lighting power limits, follow the steps outlined below using the *Lighting Application Worksheet* included with this guide.

Determining Allowed Watts for an Entire Building

First, if your project applies to the entire building, determine if an appropriate building type category is listed in Section 1, Column A on the Lighting Application Worksheet. Next, determine if Column B assigns a value for the entire building. If so, enter the square footage of the entire building in Column D. (If the value in Column B is N/A, follow the steps for tenant area or portion of building in the following section.) Multiply

the watts per sq ft in Column B by the square footage in Column D to determine the allowed watts. Enter the results in Column E.

This example shows how to calculate the total allowed watts for new general office space occupying an entire building totaling 10,000 sq ft. This building has a 1.7 watt per sq ft allowance. The total allowed watts value for the building is determined by multiplying Column B by Column D (17,000 watts).				
Section 1 – Allowed Lighting Power Calculation				
A	B	C	D	E
Building or Area Type	Entire Building (watts per sq ft)	Tenant Area or Portion of Building (watts per sq ft)	Building or Space (sq ft)	Allowed Watts** (B or C x D)
Office	1.7	1.8	10,000	17,000
Total Allowed Watts				17,000
**May use only Column B or Column C to qualify project. Do not use more than one column.				

Example - Determining Allowed Watts for an Entire Building

This example shows how to calculate the total allowed watts for new general office space occupying tenant area totaling 10,000 sq ft. The watts per sq ft allowance for this building is a combination of general office and corridor, restroom, and support areas. The total allowed watts value for the building is determined by multiplying the watts per sq ft for each area in Column C by the square footage of each area in Column D. The total allowed watts value is determined by adding the values in Column E (17,000 watts).				
Section 1 – Allowed Lighting Power Calculation				
A	B	C	D	E
Building or Area Type	Entire Building (watts per sq ft)	Tenant Area or Portion of Building (watts per sq ft)	Building or Space (sq ft)	Allowed Watts** (B or C x D)
Corridor, Restroom, Support Area	N/A	0.8	1,000	800
Office	1.7	1.8	9,000	16,200
Total Allowed Watts				17,000
**May use only Column B or Column C to qualify project. Do not use more than one column.				

Example - Determining Allowed Watts for Tenant Area or Portion of Building

Determining Allowed Watts for Tenant Area or Portion of Building

If your project applies to only a portion of the entire building, is not listed as a building type, or has more than one occupancy type, circle the appropriate value for each type in Section 1, Column C on the *Lighting Application Worksheet*. Next, determine the total area of each type and enter the square footage for each in Column D. Multiply the watts per sq ft in Column C by the square footage in Column D. Enter the results in Column E. Sum the values in Column E to determine the total allowed watts.

Determining Total Actual Watts and Compliance

Next, complete Section 2 on the *Lighting Application Worksheet* to determine the total actual watts. For each fixture type in your project, list the fixture type, fixture description, quantity, and watts per fixture, including ballasts.

- For screw lamp holders, use the maximum labeled wattage of the luminaire.
- For low-voltage lighting, use the specified wattage of the transformer supplying the system.
- For all other lighting equipment, use data furnished by the manufacturer.
- For line-voltage track lighting systems, use the larger of the results from the three bullets above or 30 watts per linear foot of track.

If actual input wattages are not known, you may use values from the *Typical Lighting Wattage* tables at the end of this section; however, actual fixtures used in the building must meet or exceed the efficiency of the fixtures assumed in the compliance analysis.

Multiply the value in Column D by the value in Column E to calculate the total watts for each fixture type. Enter the results in Column F. Sum the values in Column F to determine the total actual watts. If you need to list more equipment, use additional worksheets as continuation sheets.

Finally, determine if your project complies by completing Section 3 on the *Lighting Application Worksheet*. First, enter the total allowed watts on line 1. If you used additional worksheets as continuation sheets, don't forget to include values from each additional sheet in this total. Next, enter the total actual watts on line 2. Subtract line 1 from line 2 to determine compliance. The project complies if line 3 is zero or greater.

This example shows how to complete Sections 2 and 3 of the <i>Lighting Application Worksheet</i> . The interior of this example building is lit with two high-efficiency lighting groups—recessed PL downlights and a 2x4 fixture with electronic ballasts and T-8 lamps. This system also includes standard incandescent lamps. Adding the values in Column F shows that this project will have 16,660 total actual watts of installed interior lighting.					
Section 2 – Actual Lighting Power Calculation					
A	B	C	D	E	F
Fixture ID	Fixture Description	Lamp/Ballast	Quantity	Watts per Fixture	D x E
F1	2x4 Recessed Troffer	T8/Electronic	110	121	13,310
F2	Recessed CFL Fixture	CFL 18	50	22	1,100
F3	Medium-Base Socket	100 W	30	75	2,250
Total Actual Watts					16,660
The value resulting from subtracting the total actual watts from the total allowed watts indicates if the project complies. Our example project complies by 340 watts and, if properly switched, controlled, and wired, complies with the lighting requirements.					
Section 3 – Compliance Calculation					
1	Total Allowed Watts				17,000
2	Total Actual Watts				16,660
3	Project Compliance (line 1 – line 2; must be zero or greater)				340

Example - Determining Total Actual Watts and Lighting Compliance

Exterior Lighting Requirements

Exterior lighting must meet the following criteria to comply:

- All lighting supplied through the building electrical service must comply.
- Energy-efficient lighting must be used when illuminating paths, walkways, and parking areas. Complying types of energy-efficient lighting sources include fluorescent lamps and ballasts, compact fluorescents, metal halide lamps and ballasts, and high-pressure sodium lamps and ballasts.
- Any lighting that has an efficacy of 45 lumens per watt or greater is allowed for exterior lighting.

These requirements do not apply to

- specialized signal, directional, and marker lighting associated with air, rail, water, and road transportation
- lighting used to highlight features of registered historic landmark structures or buildings
- lighting integral to advertising signage
- lighting used for safety or security specifically designed to meet health or life safety requirements
- low-voltage lighting used exclusively for landscaping.

Completing Lighting Compliance Certificate

These instructions explain the information to include in the *COMcheck-EZ* Lighting Compliance Certificate, identify the appropriate contact or reference if you have questions, provide *EZ* tips for completing the certificate, and provide instructions for completing the Lighting Power Calculation. A sample certificate and worksheet are also provided. The instructions have numbered circles that correspond to those on the sample certificate and worksheet. For code enforcement officials, *EZ* tips for plan check and field inspection are included at the end of this guide.

General Guidance

For Documentation Authors: Provide all information in unshaded sections, entering "N/A" if a particular requirement is not applicable; submit the completed certificate to the authority having jurisdiction with the building permit application package.

For Plan Checkers: Verify that proposed values listed on the certificate are consistent with the plans and specifications and with the requirements in this guide.

For Field Inspectors: Inspect and approve building construction against each requirement in Section 3 of the certificate.

Typical Lighting Wattage

Typical T8/T12 Fluorescent Input Wattage

Lamp Length	Lamp Quantity	Lamp Description	Lamp Wattage	Energy-Efficient Magnetic Ballast (EEF)	Electronic Ballast (ELC)
2 ft	1	T12U	40	46	36
	2	T12U	40	86	67
	3	T12U	40	130	101
	1	T12U ES	34	41	31
	2	T12U ES	34	72	59
	3	T12U ES	34	109	89
	1	T8U	32	36	35
	2	T8U	32	69	62
	3	T8U	32	105	75
	1	T8	17	24	22
	2	T8	17	45	33
	3	T8	17	---	54
	4	T8	17	---	65
	3 ft	1	T8	25	33
2		T8	25	65	48
3		T8	25	---	72
4		T8	25	---	93
1		T12	30	46	---
2		T12	30	79	---
3		T12	30	122	---
1		T12 ES	25	42	26
2		T12 ES	25	70	53
3		T12 ES	25	114	---
4 ft	1	T8	32	37	32
	2	T8	32	70	65
	3	T8	32	107	95
	4	T8	32	140	124
	1	T10	42	46	37
	2	T10	42	92	74
	3	T10	42	138	111
	4	T10	42	184	148
	1	T12	40	45	37
	2	T12	40	84	72
	3	T12	40	125	106
	4	T12	40	160	142
	1	T12 ES	32	38	---
	2	T12 ES	32	68	---
	3	T12 ES	32	103	---
	4	T12 ES	32	136	---
	1	T12 ES	34	42	32
	2	T12 ES	34	70	62
	3	T12 ES	34	109	92
	4	T12 ES	34	139	123
	1	T12 Slim	39	51	---
	2	T12 Slim	39	82	---
	1	T12 Slim ES	32	59	---
	2	T12 Slim ES	32	98	---
5 ft	1	T8	40	50	46
	2	T8	40	92	79
	3	T8	40	---	109
8 ft	1	T8	75	79	65
	2	T8	75	158	130
	3	T8	75	237	195
	4	T8	75	316	260
	1	T8 ES	60	62	53
	2	T8 ES	60	123	105
	3	T8 ES	60	185	158
	4	T8 ES	60	246	210
	1	T12 Slim	75	100	---
	2	T12 Slim	75	166	130
	3	T12 Slim	75	---	195
	4	T12 Slim	75	316	260
	1	T12 Slim ES	60	83	---
	2	T12 Slim ES	60	131	105
	4	T12 Slim ES	60	246	210

8 ft	1	T12 HO	110	140	---
	2	T12 HO	110	245	190
	4	T12 HO	110	474	380
	1	T12 HO ES	95	125	---
	2	T12 HO ES	95	217	160
	4	T12 HO ES	95	416	320

--- No typical wattage value available

T12 1½-inch diameter fluorescent lamp

T10 1 ¼-inch diameter fluorescent lamp

T8 1-inch diameter fluorescent lamp

U "U"-shaped fluorescent lamp

ES Energy -saving lamp—typically lower wattage than its standard counterpart

Slim A type of lamp with single end-pins for instant start operation only

HO A high output lamp having higher input wattage and higher light output than standard lamp of that size

Typical Compact Fluorescent Input Wattage

Lamp Quantity	Lamp Type	Lamp Wattage	Magnetic Ballast (MAG)	Electronic Ballast (ELC)	
1	Twin Tube	8/9	13	---	
2		8/9	26	---	
1		13	17	---	
2		13	34	---	
1		18	23	17	
2		18	46	35	
3		18	69	52	
4		18	92	70	
1		24/26/27	32	21	
2		24/26/27	66	43	
3		24/26/27	99	64	
4		24/26/27	132	86	
1		36/39	51	37	
2		36/39	66	70	
3		36/39	108	106	
4		36/39	132	140	
1		40	43	36	
2		40	86	71	
3		40	130	104	
4		40	172	142	
1		50	---	54	
2		50	---	106	
3		50	---	139	
4		50	---	212	
1		55	---	62	
1		Triple 4-pin	13	18	---
2			13	36	---
1			18	25	---
2			18	50	---
1			26	37	---
2	26		74	---	
1	Quad 2-pin	9	13	---	
2		9	26	---	
1		13	17	---	
2		13	34	---	
1		16	20	---	
2		16	40	---	
1		18	24	---	
2		18	47	---	
1		22	27	---	
2		22	54	---	
1		26	32	---	
2		26	65	---	
1		28	34	---	
2		28	68	---	
1	Quad 4-pin	10	15	---	
2		10	29	---	
1		13	17	---	
2		13	34	---	
1		18	24	---	
2	18	47	---		

Twin Tube A lamp consisting of two parallel tubes attached to a base with typically 2 pins.
 Triple 4-pin A lamp consisting of three parallel tubes attached to a base with 4 pins.
 Quad 2-pin A lamp consisting of four parallel tubes attached to a base with 2 pins.
 Quad 4-pin A lamp consisting of four parallel tubes attached to a base with 4 pins.

Typical HID Input Wattage

Lamp Description	Lamp Wattage	Magnetic Ballast (MAG)	Lamp Description	Lamp Wattage	Magnetic Ballast (MAG)
Metal Halide	50	67	High-Pressure Sodium	35	43
	70	95		50	64
	75	85		70	94
	100	130		100	130
	150	210		150	190
	175	210		20	245
	250	295		250	300
	400	465		400	465
	1000	1080		1000	1100
1500	1625				

Sample Lighting Compliance Certificate for the 90.1 ('89) Code

ALL INFORMATION MUST BE FILLED IN - PRINT CLEARLY

Section 1 - Project Information

1 Project Name The Ultimate Pizza Place	Permit # M9958
2 Address 1234 Jobsite, USA	Date 12/16/00
3 Owner/Agent Cris Doe	Telephone (333) 337-2121
4 Documentation Author Jeff A. Jackson, PE	Checked By B. Jones
	Date 1/20/01
For Department Use Only	

Section 2 - General Information

5 Building Floor Area	12,500 ft²
6 Project Description	<input checked="" type="checkbox"/> New Construction <input type="checkbox"/> Addition <input type="checkbox"/> Alteration
7 Method of Lighting Compliance	<input checked="" type="checkbox"/> Entire Building <input type="checkbox"/> Tenant Area or Portion of Building

Section 3 - Requirements Checklist

	Inspection Date	Approved By	Notes
8 Controls, Switching, and Wiring			
Independent controls for each space (switch/occupancy sensor) Exceptions: security lighting building lobby/retail store/mall	<u>5/20/01</u>	<u>AJ</u>	1) Only one switch in small banquet room two needed
Master switch at entry to each hotel/motel guest room	<u>NA</u>	<u>NA</u>	
Two switches, dimmer, or occupancy sensor in each space providing a uniform illumination pattern (see note) Exceptions: the area has only one luminaire an occupant-sensing device controls the area the area is a corridor, storage area, restroom, or lobby	<u>5/25/01</u>	<u>AJ</u>	2) Replace several four-lamp fixtures in dining area with three-lamp fixtures
Photocell or astronomical time-switch on exterior lights Exception: large covered areas requiring lighting during daylight hours	<u>5/25/01</u>	<u>AJ</u>	
Tandem-wired one-lamp and three-lamp ballasted luminaires (see note) Exceptions: electronic high-frequency ballasted luminaires luminaires not on same switch	<u>5/25/01</u>	<u>AJ</u>	3) Wattage exceeded by these units. PK 5/20/01
9 Interior Lighting			
Total actual watts must be less than or equal to total allowed watts	(see note)		Fixtures, lamps and wattage OK. PK 5/25/01
10 Allowed Watts	Actual Watts	Lighting Complies (Y/N)	
21,870	21,223	Y	
External Lighting			
Type(s) of exterior-lighting sources: <input checked="" type="checkbox"/> fluorescent <input type="checkbox"/> metal halide <input type="checkbox"/> high-pressure sodium			
Lighting from electrical service: minimum of 45 lumens per watt Exceptions: specialized signal, directional, and marker lighting lighting highlighting exterior features of historic building advertising signage safety or security lighting low-voltage landscape lighting			
	<u>5/25/01</u> 2 nd Insp	<u>AJ</u>	
	<u>5/20/01</u>	<u>AJ</u>	
	<u>5/20/01</u>	<u>AJ</u>	

Section 4 - Compliance Statement

11 The proposed lighting design represented in these documents is consistent with the building plans, specifications, and other calculations submitted with this permit application. The proposed lighting system has been designed to meet the 90.1 ('89) Code lighting requirements using COMcheck-EZ™ Version 2.1.

Principal Lighting Designer - Name	Signature	Date
Jeff A. Jackson, PE	<i>Jeff A. Jackson, PE</i>	10/5/00

NOTE: This form is required on project plans. The Lighting Application Worksheet may be incorporated into the lighting schedule.

Section 1 – Project Information

- 1 **Project Name** - name used to identify the project. [?] Contact owner/agent.
- 2 **Address** - project site address. [?] Contact owner/agent.
- 3 **Owner/Agent** - overall project representative; may be owner, project manager, or design professional of record. [?] Contact owner/agent.
- 4 **Documentation Author** - individual responsible for filling out this certificate. [?] Contact owner/agent.

EZ Tips

- The design professional of record, if required, should stamp and sign plans, specifications, and subsequent revisions.

Section 2 – General Information

- 5 **Building Floor Area** - total of all heated/cooled gross floor areas measured to outer wall surfaces; include lofts and mezzanines. [?] Contact owner/agent.
- 6 **Project Description** - additions—add floor area and new lighting system(s); alterations—change an existing lighting system. [?] See pages 4-7.
- 7 **Method of Lighting Compliance** - Tenant Area or Portion of Building applies to additions or alterations of existing building lighting systems. [?] See pages 5-6.

Section 3 - Requirements Checklist

8 **Controls, Switching, and Wiring**

- Independent controls for each space** - indicate wiring and controls for each space with ceiling height partitions on the plans. [?] See page 2.
- Master switch at entry to each hotel/motel guest room** - if applicable, indicate wiring arrangement and master switch for each room on the plans. [?] See page 2.
- Two switches, dimmer, or occupancy sensor in each space** - indicate wiring arrangement for these controls for each space on the plans; provide manufacturer cut sheets if required. [?] See pages 2-3.
- Photocell or astronomical time-switch on exterior lights** - indicate these controls for each space on the plans; provide manufacturer cut sheets if required. [?] See page 3.
- Tandem-wired one-lamp and three-lamp ballasted luminaires (lights)** - indicate these controls for each space on the plans; provide manufacturer cut sheets if required. [?] See pages 3-4.

EZ Tips

- The Documentation Author confirms that plan details show all controls, switching, dimmers, occupancy sensors, exterior-light switching, lamp details, and claimed exceptions; notes listed exceptions on plans; provides manufacturer cut sheets as required.
- The Plan Checker verifies that required controls, switching, and wiring are indicated on the plans; requires manufacturer cut sheets when needed to verify compliance.
- The Field Inspector verifies that required controls, switching, and lighting fixtures are consistent with the plans (rough lighting, final).

9 Interior Lighting

Interior Lighting - total interior lighting wattage, including lamp ballasts, is included in calculations; subtract lighting exempt areas and associated wattages; reconcile all design details with plans.

? See pages 4-5.

Allowed Watts - use lighting application worksheet, building-type definitions, and design areas to compute allowed wattage.

? See pages 4-5, 7.

Actual Watts - use actual power lighting worksheet, typical fixture wattage, and building type definitions to compute total actual watts.

? See pages 8-11.

Lighting Complies - total actual wattage must be less than or equal to the total allowed wattage.

? See page 6.

EZ Tips

- The Documentation Author calculates the allowed and actual watts using the Lighting Application Worksheet and enters the values in the box provided on the Lighting Compliance Certificate; ensures worksheet entries are consistent with plan details; confirms and designates any exceptions that are claimed.
- The Plan Checker compares the calculations with the lighting plan and verifies that all **nonexempt** fixtures are included in the calculations; verifies that worksheet entries are consistent with plans.
- The Field Inspector verifies that fixture types, individual fixture wattages, and number of fixtures are consistent with plans (rough electrical, final).

10 Exterior Lighting

Types of exterior lighting - locate and label all exterior lighting on plans and specifications by type and size.

? See page 7.

(a) **Power for lighting exceptions** - locate and label all lighting exceptions on plans and specifications.

? See page 7.

EZ Tips

- Project specifications should include sufficient detail and manufacturer's literature to verify compliance with requirements. Provide a lighting schedule that shows fixture type and details. Ensure fixture locations shown on plans are keyed to the schedule.
- The Documentation Author reconciles listed requirements with plan and specification details; confirms exceptions and provides manufacturer cut sheets as required by plan review for equipment.

- The Plan Checker checks and approves plans and specifications for sufficient requirement details for the three allowable high-efficiency lighting types with an efficacy of at least 45 lumens per watt; document claimed lighting exceptions.
- The Field Inspector checks to ensure lighting is fluorescent, metal halide, or high-pressure sodium; that it has an efficacy of at least 45 lumens per watt; and that any other lighting falling under claimed exceptions is listed on the approved plans and specifications (final).

Section 4 – Compliance Statement

- 11** **Principal Lighting Designer - Name** - If required by the code official, documentation author or design professional of record must print his/her name, sign, and date the certificate in the boxes provided to acknowledge that the structure has been designed to meet the 90.1 ('89) Code lighting requirements using COMcheck-EZ Version 2.1.

EZ Tips for Lighting Enforcement

Plan Check

- Verify that required controls, switching, lighting fixture types, and wiring are indicated on the plans; require manufacturer cut sheets when needed to verify compliance.
- Verify that the worksheet entries are consistent with the plans; check the calculations on the Lighting Application Worksheet and the values transferred to the Lighting Compliance Certificate.
- Verify that all outside lights served by the building's electrical system are identified on the plans as fluorescent, metal halide, high-pressure sodium, or other lamps having an efficacy of at least 45 lumens per watt; all lamps qualifying for exceptions must be identified as such on the plans.

Field Inspection

- Verify that installed controls, switching, and lighting fixtures are consistent with the plans.
- Verify that fixture types, individual fixture wattages, and the number of fixtures are consistent with the plans.
- Verify that all outside lights served by the building's electrical system are consistent with the plans.

1 Sample Lighting Application Worksheet for the 90.1 ('89) Code

Section 1 - Allowed Lighting Power Calculation				
A	B	C	D	E
2 Building or Area Type	3 Entire Building (watts per sq ft)	4 Tenant Area or Portion of Building (watts per sq ft)	5 Building or Space (sq ft)	6 Allowed Watts* (B or C x D)
Auditorium	NA	1.6		
Bank/financial institution	NA	2.0		
Classroom/lecture hall	NA	2.0		
Convention, conference or meeting center	NA	1.8		
Corridor, restroom, support area	NA	0.8	1,700	1,360
Dining	NA	2.5	5,300	13,250
Exercise center	0.9	1.0		
Exhibition hall	NA	2.6		
Grocery store	2.8	2.8		
Gymnasium playing surface	NA	1.5		
Hotel function	NA	2.4		
Industrial work, < 20 ft ceiling height	NA	1.6		
Industrial work, ≥ 20 ft ceiling height	NA	2.5		
Kitchen	NA	1.4	3,900	5,460
Library	1.3	1.5		
Lobby--hotel	NA	1.9		
Lobby--other	NA	1.0	350	350
Mall, arcade, or atrium	NA	1.4		
Medical and clinical care	1.8	1.8		
Museum	1.7	1.7		
Office	1.7	1.8	250	450
Religious worship	2.2	2.5		
Restaurant	1.7	1.7		
Retail sales, wholesale showroom	2.8	3.1		
School	1.9	NA		
Storage, industrial and commercial	0.6	1.0	1,000	1,000
Theater--motion picture	1.1	1.0		
Theater--performance	1.4	1.5		
Other	0.6	0.6		
Total Allowed Watts				21,870

*May use only Column B or Column C to qualify project. Do not use more than one column.

Section 2 - Actual Lighting Power Calculation					
7 A	8 B	9 C	10 D	11 E	12 F
Fixture ID	Fixture Description	Lamp/Ballast	Quantity	Watts per Fixture	D x E
FL1	2x4 Fluor.direct/louvered	2-T8/Elec.	11	65	715
FL2	2x4 Fluor. direct/lensed	2-T8/Elec.	155	65	10,075
FL3	2x4 Fluor. direct/indirect	2-T8/Elec.	20	65	1,300
FL4	Fluor. Linear Wallwash	1-T8/Elec.	9	32	288
CF1	Compact FL Wall Sconce	2-13W CF/Mag.	30	34	1,020
CF2	Compact FL Rec.Downlt.	2-18W CF/Mag.	23	35	805
TH1	Halogen Rec. Downlt.	1-60W Halogen	36	60	2,160
INC1	Incand. Rec. Downlt.	1-75W Incand.	28	75	2,100
TH2	Halogen Track Light	1-60W Halogen	46	60	2,760
Total Actual Watts					21,223

Section 3 - Compliance Calculation		
1		Total Allowed Watts
2		Total Actual Watts**
3	13 Project Compliance (line 1 - line 2; must be zero or greater)	
		21,870
		21,223
		647

** Include watts from above plus watts from continuation sheet(s), if any.

Completing Lighting Application Worksheet

Use the Lighting Application Worksheet to calculate the maximum allowed lighting power for the building interior, the total actual lighting power of the design, and determine compliance. **If line 3 of the worksheet is not zero or greater after completing the calculations, the design does not comply and must be revised until it complies.** The numbered circles in these instructions correspond to those on the Sample Lighting Application Worksheet.

Section 1 - Allowed Lighting Power Calculation


- 1 **General Requirements** - supply all requested information at the level of detail indicated; do not substitute “see plans or specifications” for required information. [?] See pages 4-6.
- 2 **Building or Area Type** - select the **main** building occupancy type or area use from those listed (see Building and Area Types following blank worksheet for descriptions). [?] See pages 4-6.
- 3 **Entire Building OR** 4 **Area or Portion of Building** - if the entire building cannot be categorized under column 3, then use column 4 wattage values for each separate space type. [?] See pages 4-6.
- 5 **Building or Space** - total gross floor area of each building or area measured between inside-wall surfaces; include lofts and mezzanines. [?] See pages 4-6.
- 6 **Allowed Watts** - multiply the wattage value(s) from either the building or space by the corresponding area(s) and add to get the Total Allowed Watts. [?] See pages 4-6.

Section 2 - Actual Lighting Power Calculation

- 7 **Fixture ID** - list fixture identification names used in the project plans, specifications, and lighting schedule. [?] See pages 5-6, 8-9.
- 8 **Fixture Description** - describe the lighting fixture types in basic terms; e.g., compact fluorescents, troffers, can lights. [?] See pages 5-6, 8-9.
- 9 **Lamp/Ballast** - describe the lamp and ballast types in basic terms; e.g., mechanical, electronic. [?] See pages 5-6, 8-9.
- 10 **Quantity** - refers to fixture count and not the number of lamps. [?] See pages 5-6, 8-9.
- 11 **Watts per Fixture** - include all lamp and ballast wattages from the project design; fixture wattage values can be taken from the Lighting Wattage Defaults tables on pages 6 and 7 or obtained from the manufacturer’s specifications. [?] See pages 5-6, 8-9.
- 12 **D x E** - multiply the quantity by the watts-per-fixture values and add the column to get Total Actual Watts. [?] See pages 5-6.

Section 3 - Compliance Calculation

- 13** **Project Compliance** - copy the Total Allowed Watts and Total Actual Watts from above and calculate the difference; continue to revise the design if the Project Compliance value is not zero or greater.

 See pages 5-6.

EZ Tips

- Using values from the Typical Lighting Wattage tables can save time as an alternative to looking up values in manufacturers' catalogues. However, fixtures actually used must be at least as efficient as fixtures represented in the tables.

Lighting Compliance Certificate for the 90.1 ('89) Code

ALL INFORMATION MUST BE FILLED IN - PRINT CLEARLY									
Section 1 - Project Information									
Project Name		Permit #							
Address		Date							
Owner/Agent	Telephone	Checked By							
Documentation Author	Telephone	Date							
Section 2 - General Information									
Building Floor Area									
Project Description <input type="checkbox"/> New Construction <input type="checkbox"/> Addition <input type="checkbox"/> Alteration									
Method of Lighting Compliance <input type="checkbox"/> Entire Building <input type="checkbox"/> Tenant Area or Portion of Building									
Section 3 - Requirements Checklist									
<p>Controls, Switching, and Wiring</p> <p>Independent controls for each space (switch/occupancy sensor) Exceptions: security lighting building lobby/retail store/mall</p> <p>Master switch at entry to each hotel/motel guest room</p> <p>Two switches, dimmer, or occupancy sensor in each space providing a uniform illumination pattern Exceptions: the area has only one luminaire an occupant-sensing device controls the area the area is a corridor, storage area, restroom, or lobby</p> <p>Photocell or astronomical time-switch on exterior lights Exception: large covered areas requiring lighting during daylight hours</p> <p>Tandem-wired one-lamp and three-lamp ballasted luminaires Exceptions: electronic high-frequency ballasted luminaires luminaires not on same switch</p> <p>Interior Lighting</p> <p>Total actual watts must be less than or equal to total allowed watts</p>	<p>Inspection Date</p>	<p>Approved By</p>	<p>Notes</p>						
<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <th style="width: 20%;">Allowed Watts</th> <th style="width: 20%;">Actual Watts</th> <th style="width: 60%;">Lighting Complies (Y/N)</th> </tr> <tr> <td style="height: 20px;"> </td> <td> </td> <td> </td> </tr> </table>	Allowed Watts	Actual Watts	Lighting Complies (Y/N)						
Allowed Watts	Actual Watts	Lighting Complies (Y/N)							
<p>External Lighting</p> <p>Type(s) of exterior-lighting sources: <input type="checkbox"/> fluorescent <input type="checkbox"/> metal halide <input type="checkbox"/> high-pressure sodium</p> <p>Lighting from electrical service: minimum of 45 lumens per watt Exceptions: specialized signal, directional, and marker lighting lighting highlighting exterior features of historic building advertising signage safety or security lighting low-voltage landscape lighting</p>									
Section 4 - Compliance Statement									
<p><i>The proposed lighting design represented in these documents is consistent with the building plans, specifications, and other calculations submitted with this permit application. The proposed lighting system has been designed to meet the 90.1 ('89) Code lighting requirements using COMcheck-EZ™ Version 2.1.</i></p>									
Principal Lighting Designer - Name		Signature	Date						
<p>NOTE: This form is required on project plans. The Lighting Application Worksheet may be incorporated into the lighting schedule.</p>									

Lighting Application Worksheet for the 90.1 ('89) Code

Section 1 - Allowed Lighting Power Calculation					
A	B	C	D	E	
Building or Area Type	Entire Building (watts per sq ft)	Tenant Area or Portion of Building (watts per sq ft)	Building or Space (sq ft)	Allowed Watts* (B or C x D)	
Auditorium	NA	1.6			
Bank/financial institution	NA	2.0			
Classroom/lecture hall	NA	2.0			
Convention, conference or meeting center	NA	1.8			
Corridor, restroom, support area	NA	0.8			
Dining	NA	2.5			
Exercise center	0.9	1.0			
Exhibition hall	NA	2.6			
Grocery store	2.8	2.8			
Gymnasium playing surface	NA	1.5			
Hotel function	NA	2.4			
Industrial work, < 20 ft ceiling height	NA	1.6			
Industrial work, ≥ 20 ft ceiling height	NA	2.5			
Kitchen	NA	1.4			
Library	1.3	1.5			
Lobby--hotel	NA	1.9			
Lobby--other	NA	1.0			
Mall, arcade, or atrium	NA	1.4			
Medical and clinical care	1.8	1.8			
Museum	1.7	1.7			
Office	1.7	1.8			
Religious worship	2.2	2.5			
Restaurant	1.7	1.7			
Retail sales, wholesale showroom	2.8	3.1			
School	1.9	NA			
Storage, industrial and commercial	0.6	1.0			
Theater--motion picture	1.1	1.0			
Theater--performance	1.4	1.5			
Other	0.6	0.6			
Total Allowed Watts					
*May use only Column B or Column C to qualify project. Do not use more than one column.					
Section 2 - Actual Lighting Power Calculation					
A	B	C	D	E	F
Fixture ID	Fixture Description	Lamp/Ballast	Quantity	Watts per Fixture	D x E
Total Actual Watts					
Section 3 - Compliance Calculation					
1				Total Allowed Watts	
2				Total Actual Watts**	
3	Project Compliance (line 1 - line 2; must be zero or greater)				

** Include watts from above plus watts from continuation sheet(s), if any.

Whole Building Types

Exercise center – A building or structure used for recreational activities involving physical exertion designed to promote physical fitness and well-being.

Grocery store – A building or structure that has as its primary purpose the sale of foodstuffs requiring additional preparation prior to consumption.

Library – A building or structure in which literary and artistic materials, such as books, periodicals, and audiovisuals, are kept for reading, reference, and loan.

Medical and clinical care – A building or structure for the purpose of providing medical treatment, confinement or care, and sleeping facilities such as hospitals, sanitariums, clinics, orphanages, nursing homes, mental institutions, and reformatories.

Museum – A building used for the display and preservation of objects of artistic, scientific, or cultural interest.

Office – A building or structure for office, professional, or service type transactions such as medical offices, banks, libraries, and government office buildings.

Religious worship – A building for worship, religious services, and associated social and educational functions.

Restaurant – A building or structure for the preparation and consumption of food or drink, including coffee shops, cafeterias, bars, and fast food and leisure restaurants.

Retail sales, wholesale showroom – A building or structure for the display and sale of merchandise such as shopping malls, food markets, auto dealerships, department stores, and specialty shops.

School – A building or structure for the purpose of instruction, such as schools, colleges, universities, and academies.

Storage, industrial and commercial – A building or structure for storage, such as aircraft hangars, garages, warehouses, storage buildings, and freight depots.

Theater—motion picture – An assembly room, hall, or building with tiers of rising seats or steps for the showing of motion pictures.

Theater—performance – An assembly room, hall, or building with tiers of rising seats or steps for the viewing of dramatic performances, lectures, musical events, and similar live performances.

Other – A building or structure whose intended use is currently not known or does not match any of the above categories.

Area Use Categories

Auditorium – An area with fixed seats used for public meetings or gatherings not specifically for the viewing of dramatic performances.

Bank/financial institution – An area for conducting financial transactions including the custody, loan, exchange, or issue of money, for the extension of credit, and for facilitating the transmission of funds.

Classroom/lecture hall – An area of a building where classes meet.

Convention, conference or meeting center – an area used for meetings, conventions, and multiple purposes, including dramatic performances, that has neither fixed seating nor fixed staging.

Corridor, restroom, support area – Corridor: an area used as a passageway to access compartments or rooms. Restroom: An area providing personal facilities such as toilets and washbasins. Support: An area used as a passageway, utility room, storage space, or other use associated with the building's primary function.

Dining – An area in a restaurant or hotel/motel (other than guest rooms) where meals served to the customers are consumed.

Exercise center – An area of a building for recreational activities involving physical exertion designed to promote physical fitness and well-being.

Exhibition hall – An area used for exhibition that has neither fixed seating nor fixed staging.

Grocery store – An area of a building that has as its primary purpose the sale of foodstuffs requiring additional preparation prior to consumption.

Gymnasium playing surface – An area of a building for organized athletic games, such as basketball, volleyball, racquetball, and tennis.

Hotel function – An area such as a hotel ballroom, meeting room, exhibit hall, or conference room, together with prefunction area and other spaces ancillary to its function.

Industrial work, < 20 ft ceiling height – An area of a building in which a manufacturing operation, craft, or art is performed having a ceiling less than 20 ft above the floor.

Industrial work, ≥ 20 ft ceiling height – An area of a building in which a manufacturing operation, craft, or art is performed having a ceiling 20 or more ft above the floor.

Kitchen – An area containing facilities for cooking and food preparation.

Library – An area of a building in which literary and artistic materials, such as books, periodicals, and audiovisuals, are kept for reading, reference, and loan.

Lobby—hotel – An area in a hotel/motel between the main entrance and the front desk, including waiting and seating areas, and other spaces encompassing the activities normal to a hotel lobby function.

Lobby—other – An area located directly inside the main entrance of a building and includes the reception area, sitting areas, and public areas.

Mall, arcade, or atrium – An area of a building used as a public passageway or concourse that provides access to rows of stores or shops.

Medical and clinical care – An area of a building where medical treatment is provided, such as hospitals, sanitariums, clinics, orphanages, nursing homes, mental institutions, and reformatories.

Museum – An area of a building used for the display or preservation of objects of artistic, scientific, or cultural interest.

Office – An area of a building for office, professional, or service-type transactions such as medical offices, banks, libraries, and government office buildings.

Religious worship – An area of a building for worship or religious services.

Restaurant – An area of a building for the preparation and consumption of food or drink, including coffee shops, cafeterias, bars, and fast food and leisure restaurants.

Retail sales, wholesale showroom – An area of a building in which the primary activity is the sale of merchandise or the display of samples of merchandise.

Storage, industrial and commercial – An area of a building for storing items.

Theater—motion picture – An area of a building with tiers of rising seats or steps for the showing of motion pictures.

Theater—performance – An area of a building with tiers of rising seats or steps for the viewing of dramatic performances, lectures, musical events, and similar live performances.

Other – An area of a building whose intended use is currently not known or does not match any of the above types.