

Oregon Non-Residential Building Energy Code



OREGON
DEPARTMENT OF
ENERGY

Interior Connected Lighting Power

Requirements

The requirements for interior lighting power are one of the most important sections of the Oregon Energy Code. They set a maximum for the installed electrical power of interior building lighting. As with the other sections of the Standard, however, the lighting criteria are minimum requirements. Through improved technology and thoughtful design, quality lighting with even greater efficiency can be achieved.

There are two methods for determining the interior lighting power allowance. The tenant space method (1313.4.1) is the simplest and is appropriate for an entire building or an entire tenant space within a building. The space-by-space method (1313.1.2) accounts for specific lighting applications and can distinguish, for instance, between various types of seating areas in an auditorium. This method offers more flexibility and may result in a higher lighting power allowance for some applications. Both methods establish a budget for the entire building. The budget may be distributed throughout the building in any way seen fit by the designer (traded off), so long as total tenant space or building budget is not exceeded.

Note that these lighting allowances apply regardless of whether a space, such as a warehouse, is heated or unheated. Also, be aware that some outdoor spaces such as covered (but open) parking garages and canopies (including service station canopies) are included as interior lighting for the purposes of the requirements.

Non-Regulated Lighting

Most interior lighting must be included in the calculations of installed lighting power. However, certain specialized lighting is exempt as defined in exceptions 1 and 2 of 1313.1. The lighting identified in exception 1 is categorically exempt, such as athletic fields. However, the lighting applications identified in exception 2 are exempt only if they are not the only lighting source in the space and if they are controlled by an independent control device. Exempt lighting can be ignored when determining the installed lighting power for comparison against the lighting power allowance.

Tenant Space Method (1313.4.1)

The tenant space method assigns a single interior lighting power density in W/ft² based on the type of tenant space (see Table 13-G of the Code.) If a tenant space type is not listed in Table 13-G, the closest match should be chosen with the approval of the local building official. The lighting power density is multiplied by

Continues on page 2

Code Language

1313.1 General.The provisions in this section apply to lighting equipment, related controls and electric circuits serving the interior spaces of other buildings, exterior building facades (including illuminated roofs and other architectural features), and exterior areas such as entrances, exits, loading docks, illuminated canopies, roads, open parking, exterior retail and landscaping.

Alterations to existing buildings shall comply with Section 1313.6.

Exceptions:

1. Lighting for the following areas:
 - 1.1 Outdoor athletic facilities.
 - 1.2 Dwelling units, lodging houses, one or two family dwellings and guest rooms.
 - 1.3 Industrial plants—manufacturing spaces only.
 - 1.4 Paint shops and painting spray booths.
 - 1.5 High-risk security areas such as detention facilities, automatic teller machines (ATMs) and night drops.
 - 1.6 Areas specifically designed for visually disabled people.
 - 1.7 Tunnels.
2. Lighting equipment used for the following shall be exempt provided that it is in addition to general lighting and is controlled by an independent control device:
 - 2.1 Production lighting for theatrical, television, spectator sports and similar performance areas.
 - 2.2 Decorative, special effect and production lighting for those portions of entertainment facilities such as theme parks, night-clubs, discos and casinos where lighting is an essential technical element for the function performed.
 - 2.3 Lighting equipment for sale.
 - 2.4 Task lighting for medical and dental purposes.

Documentation:

The Non-Residential Energy Code Compliance Manual has compliance forms both in manual and electronic form that may be used to show compliance with these requirements. These forms are supported by instructions and data tables.



Code Language continues on page 2

- 2.5 Bench lighting for research laboratories.
- 2.6 Lighting to be used solely for indoor plant growth during the hours of 10:00 p.m. to 6:00 a.m.
- 2.7 Emergency lighting that is automatically off during normal building operation.
- 2.8 Art accent lighting required for art exhibits or displays in galleries, museums and monuments.
- 2.9 Sign lighting.
- 2.10 Nonpermanent lighting.

1313.2 Luminaire wattages. Lighting luminaire wattage shall be determined in the following manner:

1. Incandescent luminaires. The maximum rated lamp wattage permitted in the luminaire shall be the luminaire's wattage for the purpose of this standard.
2. Luminaire wattage shall be input wattages including lamp and ballast losses, determined from values approved by the Building Codes Administrator. If a nonstandard product or system is used, ANSI input wattages shall be from the manufacturer's literature.
3. For compliance with this chapter, track lighting shall be calculated at 37.5 watts per linear foot (123 W/m) of track or the maximum circuit load as determined by the overcurrent device protecting the track, whichever is less.

1313.4 Interior connected lighting power. The interior connected lighting power shall not exceed the interior power allowance established in either Section 1313.4.1 or 1313.4.2.

Where multiple, independently operating lighting systems serve the same space and are controlled to prevent simultaneous operation, the connected lighting power shall be based on the system with the highest connected lighting power.

1313.4.1 Tenant space power allowance method. The total interior connected lighting power shall not exceed the maximum power allowance calculated by multiplying the lighting power density(ies) from Table 13-G based on the predominant use by the floor area of the entire tenant space or building.

1313.4.2 Space-by-space method. The total interior connected lighting power shall not exceed the maximum power allowance calculated by multiplying the lighting power density from Table 13-H for each space by the floor area of that space.

1313.4.2.1 Additional lighting power for retail displays. For retail display lighting that is specifically directed to highlight retail merchandise and controlled separately from the space general light system, an additional lighting power allowance shall be calculated as follows:

the gross lighted area of the building to determine the interior lighting power allowance. The gross lighted area is measured to the outside surface of exterior walls and to the center line of partitions that separate tenant spaces. The gross lighted area may also include garages and service station canopies.

The tenant space method is the easiest way of determining the lighting power allowance. In the case of an office, the tenant space allowance is 1.0 W/ft². This is an average for the typical mix of spaces included in an office, e.g. conference rooms, rest rooms, lobbies and corridors.

Space-by-Space Method (1313.4.2)

The space-by-space method is the second of the two methods for determining interior lighting power allowance. This approach offers greater flexibility and is applicable for all building types; however, it requires more time and effort. Rather than looking up the lighting power allowance for an entire building, the lighting power allowance is determined separately for each space within a building and then summed. The space-by-space allowances are included in Table 13-H of the Code.

The space-by-space method has two categories of allowances; common space types are applicable to any building while specific space types are particular to the building type. For instance, a courthouse has specific space types for the courtroom and judges' chambers. These space types are unique to a courthouse and may only be used for courthouses. The common space types are appropriate for any building. If a particular space type is not listed in Table 13-H, the closest match should be chosen with the approval of the local building official.

The compliance process is to divide the gross lighted area of the building into each of the space types. The lighting power allowance for each space type is determined by multiplying the gross lighted area of the space times the lighting power density (from Table 13-H). The gross lighted area is measured to the outside of exterior walls and to the centerline of partitions. The allowance for the whole building is the sum of the allowances for each of the applicable space types.

Under the space-by-space method, an additional lighting power of 1.75 W/ft² is allowed for retail display lighting (up to a maximum of 17,500 Watts per space). This allowance applies only to the sales area of the retail store and does not include storage rooms, offices or other support spaces. Additional power shall be allowed only if the specified lighting is installed, used only for the specified display lighting luminaires, and not used for any other purpose or in any other space. The term "use-it-or-lose-it" applies for this type of lighting allowance. The additional display lighting shall be separately circuited, switched and controlled.

Installed Interior Lighting Power (1313.2)

Once the interior lighting power allowance has been determined, it is then necessary to calculate the connected lighting power

and to show that this value is less than or equal to the allowance. Interior connected lighting power is simply the sum of the input wattage of all nonexempt luminaires in the building. Luminaire wattage must be determined in accordance with 1313.2.

The installed or connected lighting power – which is compared to the allowed lighting power – must include not only that of the lamp, but also the power used by the ballast or the transformer used to power lamps.

Table 5c of the Non-Residential Energy Code Compliance Manual has default data on lamp and ballast power for typical lamp/ballast combinations used in common luminaires. If the appropriate lamp ballast combination is not included in Table 5c, use the manufacturer's data for luminaire wattages and include a catalogue cut sheet with the compliance submittal.

Some lighting applications have multiple systems that are not intended for simultaneous operation. For example, a multi-function room in a hotel might have one lighting system with incandescent downlights suitable for ballroom activities and another lighting system to provide office-level illumination for meetings and conferences. If controls are implemented to prevent the simultaneous operation of multiple lighting systems, then it is only necessary to consider the lighting system with the greatest power when determining compliance with the Standard.

With many types of luminaires, designers may be uncertain about the wattage to use in compliance calculations. This is particularly true for luminaires capable of accepting multiple lamp sizes and for track lighting where additional luminaires can easily be added. These special cases are described below.

Incandescent and Tungsten-Halogen Luminaires without Permanently Installed Ballasts

This type of luminaire can accept lamps of many different sizes. For the purpose of determining installed interior lighting power, assume the maximum labeled wattage of the luminaire. This means that a luminaire rated for 150 W is calculated at 150 W for lighting power. This applies regardless of whether the lamp used is 75 W incandescent or 13 W screw-in compact fluorescent. To achieve credit for compact fluorescent lamps, the fixture must have a permanently installed ballast.

Luminaires with Permanently Installed Ballasts

Luminaires with permanently installed or remote ballasts shall use the input wattage of the lamp/ballast combination shown on the plans and specifications for the building. This information can be obtained from manufacturer's literature or from an independent testing laboratory. See Table 5c of the Compliance Manual

Continues on page 4

Code Language continued from page 2

Additional Lighting Power for Retail Displays = 1.75 Watts/sq. ft. multiplied by area of retail floor space (sq. ft.) up to a maximum of 17,500 Watts.

This additional lighting power shall only be used for retail display lighting in the applicable space, and shall not be used to increase lighting power allowance with other spaces or general lighting system within the space.

1313.6 Additions and alterations. Lighting systems in additions and alterations shall comply with the provisions of Section 1313. .

Exception:

Alterations to existing lighting systems that do not replace more than 50 percent of the luminaires in the permitted project and do not increase the existing total connected lighting power.

Examples

Q Do I need to consider portable desk lamps or furniture mounted lighting when I tally up the connected lighting of an office space?

A No, this lighting is considered nonpermanent (exception 2.10) and is exempt as long as it is not the only lighting and it is controlled by an independent control device.

Q I am designing an office space with no permanently mounted lighting fixtures. Ambient indirect lighting is provided by luminaires mounted on top of the furniture partitions and this is supplemented by furniture mounted task lighting. Do I need to include this lighting when I tally up the connected lighting power of the space?

A Yes. While this lighting can be considered nonpermanent since it is not hard wired, it is the only lighting in the space, and as such, does not qualify for exception 2.10.

Q The lighting system in an art gallery consists entirely of incandescent track mounted luminaires. Is this lighting exempt per exception 2.8?

A No. Since the lighting is the only lighting in the space, it is not exempt. If a secondary system were installed for use after hours, then the display lighting would be exempt.

Examples

Q The lighting system for an office building is constructed in phases. The lighting systems for the entrance lobby, rest rooms, and other common building are included with the plans and specifications for the base building. As tenants move into the building, the tenant improvement plans will include the lighting system for each tenant space. Can the tenant space method be used for the base building lighting system? What about the tenant lighting systems?

A The tenant space method may be used for either the tenant spaces or the base building when separately permitted. If the permit is for the base building only and does not include permanent lighting in the tenant spaces, the area of the tenant spaces should not be included when determining the base building budget.

Q An existing lighting system in an office is being re-lamped and re-ballasted with modern T-8 lamps and electronic ballasts. The existing luminaires are being used. Do the standards apply?

A No. Retrofits do not have to meet the lighting requirements unless more than 50% of the luminaires are being replaced or the overall connected lighting power is increased. In this case, none of the luminaries are being replaced and overall connected lighting power is being reduced.

Find Out More

Copies of code:

Oregon Building Officials Association
phone: 503-873-1157 fax: 503-373-9389

Technical Support:

Oregon Department of Energy
625 Marion Street NE phone: 503-378-4040
Salem, OR 97301-3737 toll free: 800-221-8035
www.oregon.gov/energy fax: 503-373-7806

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Photo on page 1 c/o Warren Gretz, DOE/NREL

12/05 ODOE CF-125/Fact Sheet 4

Non-residential code LIGHTING Fact Sheets include:

- Daylighting Controls
- Interior Lighting Controls
- Exterior Lighting and Controls
- Interior Connected Lighting Power

Continued from page 3

regarding data for common lamp/ballast combinations.

Line-Voltage Track Lighting

Track lighting is a very common lighting technique for display lighting in retail stores and galleries. It consists of a line-voltage, plug-in busway that allows for the addition or relocation of luminaires without having to change the wiring system. This makes it very easy to add fixtures to the track after the final occupancy permit has been issued. When accounting for track lighting that operates at line voltage, the designer must assume at least 37.5 W per lineal foot of track. A track that is 10 feet long would have a minimum of 375 W, even if only one 100 W fixture was shown in the drawings. If a track lighting system is on a separate circuit that has an overcurrent device (circuit breaker) protecting the circuit, then the maximum power is the line voltage times the maximum current.

Low-Voltage Track Lighting

Some track lighting systems use a transformer to energize the busway at 12 or 24 volts. Examples include decorative fixtures with exposed conductors. When these systems are used for interior lighting, the wattage used for compliance calculations is the maximum wattage of the transformer that supplies power to the system.

Additions and Alterations (1313.6)

The interior lighting power requirements apply to additions in the same way as they apply to new construction. The application of the requirements to alterations depends on the extent of the improvements. The requirements do not apply to minor alterations when fewer than 50% of the luminaires are replaced and when the overall connected lighting power is not increased (see the exception to 1313.6).

Examples

Q A jewelry store has display cases for rings, necklaces and bracelets. The store has three cases measuring 2 ft by 6 ft. What is the display allowance for these cases?

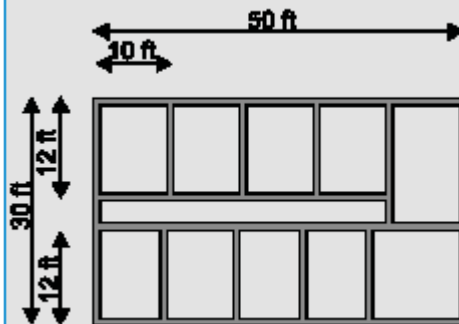
A The lighting in the display cases is considered nonpermanent lighting per exception 2.10 and does not need to be considered.

Q A 60 ft track lighting system in a gallery is on a separate circuit with a circuit breaker that trips when current exceeds 15 amps. What lighting power should be assumed for the lighting system?

A The power to be assumed is the lesser of 37.5 W/ft or the maximum power of the circuit. The maximum power of the circuit is 110 V times 15 amps or 1,650 W. The maximum power based on track length is 60 ft times 37.5 W/ft or 2,250 W. The power to be assumed is the lesser of these values or 1,650 W.

Examples

Q A building consists of 10 similar private offices ranging from 10 ft. by 12 ft. to 10 ft. by 14 ft. in size and totaling 1,350 sq. ft. (average size 135 sq. ft.) In addition, the building has 150 sq. ft. of corridors. The total floor area of the building is 1,500 sq. ft. What is the interior lighting power allowance for the building?



A Using the tenant space method, the interior lighting power allowance is 1,500 sq. ft. x 1.0 W/sq. ft. = 1,500 W. Using the space-by-space method, the allowance for the enclosed offices is 1,350 sq. ft. x 1.1 W/sq. ft. = 1,485 W. The allowance for the corridors is 150 sq. ft. x 0.5 W/sq. ft. = 75 W. The total allowed interior lighting power is 1,560 W.

Q A retail clothing store with a sales area of 1,000 sq. ft. has five display tables that are 3 ft. by 3 ft. each and a separate vertical display of dresses that measures 10 ft. wide and 6 ft. high. What additional lighting power is permitted for these displays?

A The allowance is 1.75 W/sq. ft. of retail floor space. In this case, the retail floor space is the 1,000 square feet of sales area. The additional allowance for display lighting is a maximum of 1,000 sq. ft. times 1.75 W/sq. ft. or 1,750 W. This allowance may only be used for display lighting, however, and the display lighting must highlight merchandise and be separately controlled from the general lighting area.

Q A conference room is being renovated. The existing four recessed troffers will be retained, and three new compact fluorescent recessed cans will be installed at the front of the room to illuminate displays. Do the interior lighting requirements apply?

A Yes. In this case, the interior lighting power is increased so the exception to 1313.6 does not apply. If the existing luminaires were re-lamped and re-ballasted so that the connected lighting power for the room does not increase, then the exception would apply.