1 Introduction

1.1 Organization and Content

This manual is designed to help building owners, architects, engineers, designers; energy consultants, builders, enforcement agencies, contractors and installers, and manufacturers comply with and enforce California Building Energy Efficiency Standards for nonresidential buildings. The manual is written as both a reference and an instructional guide and can be helpful for anyone that is directly or indirectly involved in the design and construction of energy efficient nonresidential buildings.

Ten chapters make up the manual:

- (Chapter 1) This chapter introduces the Standards and discusses the application and scope.
- Chapter 2 reviews the compliance and enforcement process, including design and the preparation of compliance documentation through acceptance testing.
- Chapter 3 addresses the requirements for the design of the building envelope.
- Chapter 4 covers the requirements for HVAC systems and water heating systems.
- Chapter 5 addresses the requirements for indoor lighting.
- Chapter 6 addresses the requirements for outdoor lighting.
- Chapter 7 addresses the requirements for sign lighting (for both indoor and outdoor applications).
- Chapter 8 addresses the requirements for refrigerated warehouses.
- Chapter 9 covers the whole building performance approach.
- Chapter 10 addresses the acceptance requirements.

Cross-references within the manual use the word ‘Section’ while references to sections in the Standards are represented by “§.”

This chapter is organized as follows:

- 1.1 Organization and Content
- 1.2 Related Documents
- 1.3 The Technical Chapters
- 1.4 Why California Needs Energy Standards
- 1.5 What’s New for 2008
- 1.6 Mandatory Measures and Compliance Approaches

- 1.7 Scope and Application
- 1.8 About the Standards

1.2 Related Documents

This manual is intended to supplement several other documents that are available from the California Energy Commission (Energy Commission). These are:

1. The Standards. This manual supplements and explains California Building Energy Efficiency Standards; it does not replace them. Readers should have a copy of the Standards to refer to while reading this manual.
2. The Reference Appendices:
3. Reference Joint Appendices contain information that is common to both residential and nonresidential buildings.
4. Reference Residential Appendices contain information that is for residential buildings only.
5. Reference Nonresidential Appendices contain information that is for nonresidential buildings only. The Nonresidential ACM Manual. The Nonresidential ACM Manual is primarily a specification for Compliance Software that is used for compliance purposes.

Note: High-rise residential and hotel/motel occupancies – For these occupancies' location and design data, opaque assembly properties are located in the Reference Joint Appendices; while mechanical and lighting information is located in the Reference Nonresidential Appendices. Water heating information is located in the Reference Residential Appendices.

Material from these other documents is not always repeated in this manual. However, if you are using the electronic version of the manual, there are often hyperlinks in this manual that will take you directly to the document that is referenced.

1.3 The Technical Chapters

Each of the six technical chapters (3 through 8) begins with an overview, which is followed by a presentation of each subsystem. For the building envelope, subsections include fenestration, insulation, infiltration, etc. For HVAC, the subsections include heating equipment, cooling equipment, and ducts. Mandatory measures and prescriptive requirements are described within each subsection or component. These determine the stringency of the Standards and are the basis of the energy budget when the performance method is used.

1.4 Why California Needs Energy Standards

Energy efficiency reduces energy costs for owners, increases reliability and availability of electricity for the State, improves building occupant comfort, and reduces environmental impact.

Energy Savings

Reducing energy use is a benefit to all. Building owners save money, Californians have a more secure and healthy economy, the environment is less negatively impacted, and our electrical grid can operate in a more stable state. The 2008 Standards (for residential and nonresidential buildings) are expected to reduce the growth in electricity use by 561 gigawatt-hours per year (GWh/y) and reduce the growth in gas use by 19.0 million therms per year (therms/y). The savings attributable to new nonresidential buildings are 459 GWh/y of electricity savings and 11.5 million therms. Savings from the application of the Standards on building alterations accounts for 270 GWh/y and 8.2 million therms. These savings are cumulative, doubling in two years, tripling in three, etc.

Electricity Reliability and Demand

Buildings are one of the major contributors to electricity demand. We learned during the 2000/2001 California energy crisis, and the East Coast blackout in the summer of 2003, that our electric distribution network is fragile and system overloads caused by excessive demand from buildings can create unstable conditions. Resulting blackouts can seriously disrupt business and cost the economy billions of dollars.

Since the California electricity crisis, the Energy Commission has placed more emphasis on demand reduction. The 2001 and 2005 Standards resulted in 330 megawatts (MW) of demand reduction. The 2008 Standards are expected to reduce electric demand by another 132 MW each year. Nonresidential buildings account for 95 MW of these savings. Like energy savings, demand savings accumulate each year.

Comfort

Comfort is an important benefit of energy efficient buildings. Energy efficient buildings include properly designed HVAC systems, which provide improved air circulation, and high performance windows and/or shading to reduce solar gains and heat loss. Poorly designed building envelopes result in buildings that are less comfortable. Oversized heating and cooling systems do not assure comfort even in older, poorly insulated and leaky buildings.

Economics

For the building owner, energy efficiency helps create a more profitable operation. From a larger perspective, the less California depends on depletable resources such as natural gas, coal and oil, the stronger and more stable the economy will remain in the face of energy cost increases. A cost-effective investment in energy efficiency helps everyone. In many ways, it is far more cost effective for the people of California to invest in saving energy than it is to invest in building new power plants.

Environment

The use of energy has led to oil spills, acid rain, smog, and other forms of environmental pollution that have ruined the natural beauty people seek to enjoy.

California is not immune to these problems, but Appliance Efficiency Regulations, the Standards, and utility programs that promote efficiency and conservation help to maintain environmental quality. Other benefits include reduced destruction of natural habitats, which in turn helps protect animals, plants, and natural systems.

Greenhouse Gas Emissions and Global Warming

Burning fossil fuel is a major contributor to global warming; carbon dioxide is being added to an atmosphere already containing 25 percent more than it did two centuries ago. Carbon dioxide and other greenhouse gasses create an insulating layer around the earth that leads to global climate change. Energy Commission research shows that most of the sectors of the State economy face significant risk from climate change including water resources (from reduced snow pack), agriculture, forests, and the natural habitats of a number of indigenous plants and animals.

Energy efficiency is a far-reaching strategy that is making an important contribution to the reduction of greenhouse gasses. The National Academy of Sciences has urged the country to follow California's lead on such efforts, saying that conservation and efficiency should be the chief elements in energy and global warming policy. Their first efficiency recommendation was simple: Adopt nationwide energy efficient building codes.

The Standards is expected to have a significant impact on reducing greenhouse gas and other air emissions: carbon dioxide would be reduced by 473,000 tons first year of construction, cumulative each year thereafter.

1.5 What's New for 2008

The process to develop the 2008 Standards began with a call for ideas in winter of 2005, moved through a series of workshops and hearings in 2005 through 2007 and concluded at the adoption hearing on April 23, 2008. Energy Commission staff, contractors, utilities and many others participated in the process. The following paragraphs summarize the principle changes that resulted.

All Buildings

1. *Revisions to: Administrative §10-103* to allow for electronic filing and compliance documentation maintenance for future use, Administrative §10-105 to clarify roles and responsibilities of state agencies for enforcement of the Standards, and Administrative §10-113 to clarify requirements for low-sloped and steep-sloped roofs.
2. *Revisions and clarifications to: §118, Mandatory Requirements for Insulation and Roofing Products.* These revisions include introduction of Solar Reflectance Index (SRI) for cool roof compliance.
3. *Revisions and clarifications to: §119,* Mandatory Requirements for Lighting Control Devices.

Nonresidential Buildings

4. *Roofing Products (Cool Roofs).* The Standards now has new prescriptive cool roof requirements for steep-sloped applications, which consist of high reflectance and high emittance for roofing products. The prescriptive standards already require high reflectance and high emittance roof surfaces in all low-sloped applications.
5. The alteration requirements for roofing products have been changed to clarify that all replacements, recovering or recoating of the exterior surface of existing nonresidential roofs shall meet the requirements of §118(i).
6. *Overall Building Envelope Method §143(b).* The prescriptive overall building envelope method has been revised to combine heating and cooling and to provide simplified trade-offs for roofing alterations.
7. *Site-Built Fenestration.* Changes to site-built fenestration requirements including the new NFRC Component Modeling Approach (CMA) certification, new fenestration acceptance requirements and changes to CEC default values in §116 and Reference Nonresidential Appendix NA6 and NA7.4.
8. *Insulation Levels §143(a).* Revised prescriptive requirements for roof, wall, and floor insulation levels in certain climate zones.
9. *Acceptance Requirements.* Basic "building commissioning", at least on a component basis, is required for electrical and mechanical equipment that is prone to improper installation. The mechanical acceptance requirements have been updated to meet the Standards requirements. There are also new acceptance requirements for envelope (fenestration) and outdoor lighting systems.
10. *Demand Control Ventilation §121(c).* Controls that measure CO_2 concentrations and vary outside air ventilation are required for spaces such as conference rooms, dining rooms, lounges, and gyms. The Standards expand the DCV requirements to multi zone systems but exempt high occupant density spaces from these requirements, and add new requirements to ensure that adequate ventilation is provided to the spaces.
11. *Refrigerated Warehouses §126.* New mandatory envelope, lighting, and mechanical requirements for refrigerated warehouses.
12. *Water Heating §113 and §145.* New mandatory and prescriptive requirement for Hotel/Motel occupancies to use residential water heating models, and new prescriptive requirement for gas water heating in nonresidential buildings.
13. *VAV systems §144(l).* New control requirements for single-zone variable (adjustable) air volume equipment.
14. *Control Systems.* Expand direct digital control systems to zone level for HVAC systems (§122), including demand shedding controls (§122), hydronic pressure reset (§144(j)), VAV zone minimums (§144(d)), and supply air temperature reset (§144(f)).
15. *Indoor Lighting §146.* The lighting power limits for some indoor lighting in the Area Category and Complete Building type of uses are reduced in

response to advances in lighting technology. New function areas and type of uses have been created. Updates for indoor lighting requirements for Tailored Method, including wall and floor display lighting.

16. *Occupant Sensors §131(d).* Added new requirements for occupant sensors in indoor areas, including offices less than 250 ft^2, multipurpose rooms of less than 1,000 ft^2, and classrooms and conference rooms of any size.
17. *Demand Response §131(g).* New demand response controls to reduce indoor lighting when signaled, including load shedding ballasts.
18. *Skylights for Daylighting in Buildings §131(c).* For prescriptive compliance in low-rise conditioned or unconditioned enclosed spaces that are greater than 8,000 ft^2 directly under a roof with ceiling heights greater than 15 ft and have a lighting power density for general lighting equal to or greater than 0.5 W/ft^2 shall meet §143(c)1-4.
19. *Side-Lighting §131(c).* Updates to require automatic daylighting controls within daylit areas near windows for some types of buildings. The definition of daylit area has been updated.
20. *Outdoor Lighting (§147)* LPDs have been revised to reflect new technologies and IESNA recommendations. Outdoor lighting compliance has been revised to introduce the “layered approach” to simplify compliance.
21. *Sign Lighting §148.* Lighting power limits (or alternative equipment efficiency requirements) apply to externally and internally illuminated signs used either indoors or outdoors. The list of alternative light sources has been expanded and reorganized to better reflect the state of technology.

1.6 Mandatory Measures and Compliance Approaches

In addition to the mandatory measures (Section 1.6.1), the Standards provide two basic methods for complying with nonresidential energy budgets: the prescriptive approach and the performance approach. The mandatory measures must be installed with either method, but note that mandatory measures may be superseded by more stringent measures under the prescriptive or performance approach.

1.6.1 Mandatory Measures

With either the prescriptive or performance compliance paths, there are mandatory measures that must always be met. Many of the mandatory measures deal with infiltration control, indoor and outdoor lighting, or sign lighting; other mandatory measures require minimum insulation levels and equipment efficiency or requirements for refrigerated warehouses. The minimum mandatory levels are sometimes superseded by more stringent prescriptive or performance requirements.

1.6.2 Prescriptive Approach

The prescriptive approach (composed of prescriptive requirements described in Chapters 3, 4, 5, and 6) is the simpler approach of the two. Each individual energy component of the proposed building must meet a prescribed minimum efficiency. The prescriptive approach offers relatively little design flexibility but is easy to use. There is some flexibility for building envelope components, such as walls, where portions of the wall that do not meet the prescriptive insulation requirement may still comply as long as they are area-weighted with the rest of the walls, and the average wall performance complies. If the design fails to meet even one of the requirements, then the system does not comply with the prescriptive approach. In this case the performance approach provides the most flexibility to the building designer for choosing alternative energy efficiency features.

1. *Building Envelope.* The prescriptive envelope requirements are determined either by the envelope component approach or the overall envelope approach. These two approaches are described in detail in Chapter 3 of this manual. The stringency of the envelope requirements varies according to climate zone and occupancy type.
2. *Mechanical.* The prescriptive mechanical requirements are described in detail in Chapter 4. The prescriptive approach does not offer any alternative approaches, but specifies equipment, features and design procedures that must be followed.
3. *Indoor Lighting.* The prescriptive lighting power requirements are determined by one of three methods: the complete building method, the area category method, or the tailored method. These three approaches are described in detail in Chapter 5. The allowed lighting under the Standards varies according to the requirements of the particular building occupancy or task requirements.
4. *Outdoor Lighting.* The Outdoor Lighting Standards are described in Chapter 6. They set power limits for various applications such as parking lots, pedestrian areas, sales canopies, building entrances, building facades and signs. The Standards also set minimum requirements for cutoff luminaires and controls. Outdoor lighting compliance is prescriptive in nature and is determined by the lighting application type (general and specific) and the lighting zone for each application. Detailed information on the outdoor lighting power allowance calculations is found beginning in Section 6.4.

1.6.3 Performance Approach

The performance approach (Chapter 9) allows compliance through a wide variety of design strategies and provides greater flexibility than the prescriptive approach. It is based on an energy simulation model of the building. The Standards specify the method for determining an energy budget for the building.

The performance approach requires an approved Computer Software program that models a proposed building, determines its allowed energy budget, calculates its energy use, and determines when it complies with the budget. Design options such as window orientation, shading, thermal mass, zonal control, and building configuration are all considered in the performance approach. This approach is used because of the flexibility and because it provides a way to find the most cost-effective solution for complying with the Standards.

The performance approach requires that the annual TDV energy be calculated for the proposed building or space, and be compared to the TDV energy budget. The performance approach may be used for envelope or mechanical compliance; envelope and mechanical compliance; envelope and indoor lighting compliance; or envelope, mechanical and indoor lighting compliance. It is not applicable to outdoor lighting, or to indoor lighting in the absence of envelope compliance.

TDV energy is the “currency” for the performance approach. TDV energy not only considers the type of energy that is used (electricity, gas, or propane), but also when it is used. Energy saved during periods when California is likely to have a statewide system peak is worth more than energy saved at times when supply exceeds demand. Appendix JA3 of the Reference Joint Appendices has more information on TDV energy.

Three basic steps are involved:

1. Design the building with energy efficiency measures that are expected to be sufficient to meet the energy budget. (The prescriptive approach requirements provide a good starting point for the development of the design.)
2. Demonstrate that the building complies with the mandatory measures (see Chapters 3, 4, 5, 6, 7 and 8).
3. Using an approved calculation method, model the energy consumption of the building using the proposed features to create the proposed energy budget. The model will also automatically calculate the allowed energy budget for the proposed building.

If the proposed energy budget is no greater than the allowed energy budget, the building complies.

If performance approach will be used for additions and alterations, see Chapter 9 for details.

1.7 Scope and Application

The Standards apply to both nonresidential and residential buildings. This manual addresses the requirements for nonresidential buildings, including hotels, motels, and high-rise residential buildings (those over three stories above grade in height). The Residential Manual addresses the requirements for low-rise residential buildings, which include the single family and duplex residential buildings.

1.7.1 Building Types Covered

The Nonresidential Standards apply to all buildings of the California Building Code (CBC) occupancies of Group A, B, E, F, H, M, R, S or U. If these buildings are directly or indirectly conditioned, they must meet all mechanical, envelope, indoor, and outdoor lighting requirements of the Standards. Those buildings that are not directly or indirectly conditioned must only meet the indoor and outdoor lighting requirements of the Standards.

The Standards do not apply to CBC Group I. This group includes such buildings as hospitals, daycare, nursing homes, and prisons. The Standards also do not apply to buildings that fall outside the jurisdiction of California Building Codes, such as mobile structures. If outdoor lighting is associated with a Group I occupancy, it is exempt from the Standards requirement; however, if the outdoor lighting is part of any of occupancy groups listed above, it must comply with the Standards requirements.

Historic Buildings

Exception 1 to §100(a) states that qualified historic buildings, as regulated by the California Historical Building Code Title 24, Part 8 or California Building Code, Title 24, Part 2, Volume I, Chapter 34, Division II are not covered by the Standards. §146(a)3Q and §147 Exception 14 clarify that indoor and outdoor lighting systems in qualified historic buildings are exempt from the lighting power allowances only if they consist solely of historic lighting components or replicas of historic lighting components. If lighting systems in qualified historic buildings contain some historic lighting components or replicas of historic components, combined with other lighting components, only those historic or historic replica components are exempt. All other lighting systems in qualified historic buildings must comply with the Standards.

The California Historical Building Code (CHBC) Section 102.1.1 specifies that all non-historical additions must comply with the regular code for new construction, including the Standards. CHBC Section 901.5 specifies that when new or replacement mechanical, plumbing, and/or electrical (including lighting) equipment or appliances are added to historic buildings; they *should* comply with the Standards, including the Appliance Efficiency Regulations.

The California State Historical Building Safety Board has final authority in interpreting the requirements of the CHBC and determining to what extent the requirements of the Standards apply to new and replacement equipment and other alterations to qualified historic buildings. It should be noted that in enacting the State Historical Building Code legislation, one of the intents of the Legislature was to encourage energy conservation in alterations to historic buildings (Health and Safety Code Section 18951).

Additional information about the CHBC can be found on the following website:

http://www.dsa.dgs.ca.gov/StateHistoricalBuildingSafetyBoard/

Contact the State Historical Building Safety Board at (916) 445-7627.

Low-rise Residential Buildings

The Residential Standards cover single-family and low-rise residential buildings (occupancy groups R1, R2, and R3) and CBC Group U buildings including:

- All single-family dwellings of any number of stories
- All duplex (two-dwelling) buildings of any number of stories

- All multi-family buildings with three or fewer habitable stories above grade (Groups R 1 and R-2)
- Additions and alterations to all the above buildings
- Residential garages for less than 8 vehicles, sheds on residential sites, and agricultural buildings

Table 1-1 – Nonresidential vs. Residential Standards

Nonresidential Standards	Residential Standards
These Standards cover all nonresidential occupancies (Group A, B, E, F, H, M, R, S or U), as well as high-rise residential (Groups R-1 and R-2 with four or more habitable stories), and all hotel and motel occupancies.	Note: U occupancies (i.e. sheds) may be on either Residential or Nonresidential sites. These Standards cover all low-rise residential occupancies including:
Offices Retail and wholesale stores Grocery stores Restaurants Assembly and conference areas Industrial work buildings Commercial or industrial storage Schools and churches Theaters Hotels and motels Apartment and multi-family buildings, and long-term care facilities (Group R-2), with four or more habitable stories	All single family dwellings of any number of stories (Group R-3) All duplex (two-dwelling) buildings of any number of stories (Group R-3) All multi-family buildings with three or fewer habitable stories above grade (Groups R-1 and R-2) Additions and alterations to all of the above buildings Lighting requirements for dwelling units in high-rise multifamily buildings (over 3 stories) and in hotels/motels
Note: The Standards define a habitable story as one that contains space in which humans may live or work in reasonable comfort, and that has at least 50% of its volume above grade.	

1.7.4 Scope of Improvements Covered

The Standards apply to any new construction that requires a building permit, whether for an entire building, for outdoor lighting systems, for signs, or for a modernization. The primary enforcement mechanism is through the building permitting process. Until the enforcement agency is satisfied that the building, outdoor lighting, or sign complies with all applicable code requirements, including the Standards, it may withhold the building permit (or, after construction, the occupancy permit).

The Standards apply only to the construction that is the subject of the building permit application (with the exception of existing spaces that are "conditioned" for the first time, in which case existing envelope components, and existing lighting systems, whether altered or not, must also show compliance with the Standards).

Other than for lighting, the Standards apply only to buildings that are directly or indirectly conditioned by mechanical heating or mechanical cooling. Section 1.7.177 provides detailed definitions of these terms.

1.7.5 Speculative Buildings

Known Occupancy

Speculative buildings of known occupancy are commonly built by developers. For example, if a big box retail center or an office building were built on speculation, the owner would usually know the ultimate occupancy of the space but might not know the actual tenants. For this type of building, the owner has several compliance choices:

1. Declare building to be unconditioned space, forcing tenants to be responsible for envelope, interior lighting, possibly some exterior lighting, and mechanical compliance.
2. Include envelope compliance.
3. Include envelope compliance as well as mechanical and/or lighting compliance, when those systems are to be installed prior to leasing.

There are several potential pitfalls with delaying envelope compliance. For example, tenants may have a difficult time showing compliance, depending on fenestration areas and glass efficiency. An energy code update between the time of shell construction and energy compliance for a tenant improvement could make compliance even more difficult. Constructing a "big box" style building without skylights, where skylights are required under the prescriptive approach, will also create a compliance challenge (and possibly impose large costs to retrofit skylights). In most instances upgrading the envelope later increases total construction costs, as it is easier to install envelope features at time of construction of the shell than afterwards. And for buildings that are certain to be conditioned, some enforcement agencies require envelope compliance at the time of shell construction.

For information about energy compliance for tenant improvements in existing buildings, see Section 1.7.12.

An obvious example is declaring the shell to be unconditioned, not insulating the shell and having to insulate the shell as part of the tenant improvement that adds air conditioning. This increases the final cost of the building and should render the shell less valuable for spaces that are ultimately going to be conditioned.

A less obvious example is the shell of a building that will ultimately become a big box retail store or a warehouse with lighting power densities greater than 0.5 W/ft^2, ceiling heights greater than 15 ft, and an enclosed area greater than 8,000 ft^2. Such occupancies are prescriptively required to have skylights and daylighting controls. Installing skylights in the roof of the speculative building shell is less expensive than retrofitting them later. This should be considered when designing speculative shell buildings for the big box retail or warehouse market, as they will be more saleable than those requiring skylight retrofits.

Because compliance may be demonstrated for each component separately, the owner can simply demonstrate that the systems being built meet the Standards. The remaining construction and Standards compliance work can be dealt with as each tenant obtains building permits for work in their individual spaces (see Section 1.7.12).

Unknown Occupancy

Speculative buildings are often built for which the ultimate occupancy is determined at the time of leasing and not during construction of the building shell. The structure, for example, could eventually be used as an office, a warehouse, a restaurant, or retail space. Because the Standards treat these occupancies in a similar fashion, the fact that the ultimate occupancy is unknown is not a significant problem. The major items affected by the ultimate occupancy have to do with lighting and ventilation requirements. If at the time of permitting a tenant is not identified for a multi-tenant space, the tenant leased space lighting power allowances from Standards Table 146-F shall be used.

The major problem that can occur with this type of building comes when the owner elects to declare it as an unconditioned building and defer Standards compliance until such time as a tenant installs mechanical space conditioning equipment.

1.7.6 Mixed Use Buildings

Because the Standards are different for residential, high-rise residential and nonresidential buildings, and because mixed-use buildings occasionally include more than one type of occupancy, there is potential for confusion in application. The Standards address these circumstances regarding mixed-use buildings:

1. **Minor Occupancy** (Exception to §100(f)). When either residential occupancy is mixed or one of those is mixed with a nonresidential occupancy the envelope, mechanical requirements for each occupancy differ. In these cases, if the minor occupancy or occupancies occupy less than 20 percent of the total conditioned floor area, then they may optionally be treated as if they were of the major occupancy for the purpose of envelope, HVAC, and water heating. Lighting requirements in §146 through 148 or 150(k) must be met for each occupancy separately. The mandatory measures applicable to the minor occupancy, if different from the major occupancy, would still apply.
2. **Different Nonresidential Occupancies.** When both of these occupancies fall under the Nonresidential Standards, they would be dealt with together under the same compliance process.
3. **Hotel/Motel and Nonresidential Occupancies.** A hotel/motel with guest rooms, restaurants, sports facilities and/or other nonresidential occupancies is defined as hotel/motel occupancy. The only variance is that the guestroom envelope and lighting and HVAC control requirements are different from the nonresidential occupancy energy requirements that would apply to the “common” areas of the building.
4. **Mixed Residential and Nonresidential Occupancies.** These occupancies fall under different sets of Standards and are considered separately. Two compliance submittals must be prepared, each using the calculations and forms of its respective Standards.

Example 1-1

Question

A 250,000 ft² high-rise office building includes a small 500 ft² apartment on the first floor for use by visiting executives. This is clearly a residential occupancy, so is the apartment required to meet the residential requirements of the Standards, and if so which ones – high rise residential or low rise residential?

Answer

No. First of all the apartment occupies less than 20 percent of the total conditioned floor area, so it is a minor occupancy and may be treated as part of the office occupancy. Secondly, since it is located on the first floor of the building it is technically a low rise residential building. As a result, all of the residential mandatory measures apply.

1.7.7 High-rise Residential

High-rise residential buildings (four habitable stories or more) are covered by this manual and the Nonresidential Standards.

The Standards apply separately to the living quarters and to other areas within the building. Living quarters are those non-public portions of the building in which a resident lives. High-rise residential dwelling units must incorporate the envelope and mechanical elements of the Nonresidential Standards, with the lighting and service hot water needs of residential buildings. Outdoor lighting, including parking lots and garages for eight or more vehicles and for indoor or outdoor signs (other than exit signs) must comply with the Nonresidential Standards. Exit signs must comply with the Appliance Efficiency Regulations.

The following subsections discuss the special compliance requirements that apply to high-rise residential occupancies.

Mandatory Measures

The mandatory measures for envelope, mechanical and indoor lighting, outdoor lighting, and signs apply to high-rise residential buildings. Special requirements for high-rise residential buildings are summarized below:

1. Living quarters must meet the applicable indoor lighting requirements for residential buildings.
2. Outdoor lighting must meet the applicable outdoor lighting requirements of the Nonresidential Standards.
3. Indoor and outdoor signs (other than exit signs) must comply with the Nonresidential Standards. Exit signs must comply with the Appliance Efficiency Regulations.
4. High-rise residential occupancies must meet setback requirements applicable to residential occupancies.
5. Readily accessible area switching controls are not required in public areas provided switches that control the lights in public areas are accessible to authorized personnel.

6. Automatic lighting shut-off controls are not required for living quarters.

Prescriptive Compliance

The prescriptive requirements for envelope, mechanical and lighting apply to high-rise residences. The following summarize the special prescriptive requirements for high-rise residential buildings.

1. The envelope must meet the prescriptive envelope criteria for high-rise residential buildings (Standards Table 143-B).
2. High-rise residential living quarters are not required to have economizer controls.
3. High-rise residential living quarters are exempt from the nonresidential lighting power density requirements. However, lighting within the dwelling units must meet the lighting requirements of §150(k) that governs lighting in all spaces (including kitchen lighting requirements) except closets less than 70 ft² floor area. See Chapter 6 of the Residential Compliance Manual.
4. Each occupancy (other than living quarters) in the high-rise residence must comply with the Nonresidential Lighting Standards.
5. For compliance with water heating requirements, use the residential compliance.

Performance Compliance

The rules for high-rise residential performance compliance are identical to the performance compliance rules for all nonresidential buildings. The area of each function of a high-rise residence is input into the program along with its corresponding envelope, mechanical and lighting features. The Compliance Software will automatically calculate an energy budget for the standard design, and the proposed design's energy use.

1.7.8 Hotels and Motels

This section discusses both the similarities and differences between the requirements for a hotel/motel and other nonresidential or high-rise residential buildings.

The design of a hotel or motel is unique in that the design must incorporate a wide variety of occupancies and functions into one structure. The occupancies range from nonresidential occupancies to hotel/motel guest rooms. Design functions that affect guests range from the "experience of arrival" created through the main lobby's architectural features to the thermal comfort of the guest rooms. Other functions that hotel/motel designs must address include restaurants, kitchens, laundry, storage, light assembly, outdoor lighting, sign lighting, and other items that are necessary to the hotel/motel function. In short, these structures can range from simple guest rooms with a small office, to a structure encompassing a small city.

Like other occupancies, compliance is submitted for the features covered in the permit application only. The nonresidential areas must meet the envelope, mechanical, indoor lighting, outdoor lighting, and sign lighting portions of the Nonresidential Standards, and the guest room portions of hotels/motels must meet the envelope, mechanical, and lighting provisions applicable only to hotels/motel guest rooms. In essence, each portion of the building individually complies with the provisions applicable to that occupancy.

Since hotel/motels are treated as a mixture of occupancies covered by the Standards, the concepts presented at the beginning of each chapter apply to hotels/motels as they would any other nonresidential occupancy.

Mandatory Measures

The mandatory measures for envelope, mechanical, indoor lighting, outdoor lighting, and sign lighting apply to hotels/motels. The following bullets describe special requirements or exceptions for hotel/motel buildings.

1. 90 percent of the hotel/motel guest rooms must meet the applicable Lighting Standards for residential buildings.
2. Outdoor lighting must meet the applicable Outdoor Lighting Standards.
3. Indoor and outdoor signs (other than exit signs) must comply with the Nonresidential Standards. Exit signs must comply with the Appliance Efficiency Regulations.
4. Hotel and motel guest room thermostats shall have numeric temperature settings.
5. Readily accessible area switching controls are not required in public areas provided switches that control the lights in public areas are accessible to authorized personnel.
6. Automatic lighting shut-off controls are not required for hotel/motel guest rooms.

Prescriptive Compliance

The prescriptive requirements for envelope, mechanical and lighting apply to hotel/motels. The following prescriptive requirements are specific to hotel/motels:

1. Hotel/motel guest rooms must meet the prescriptive envelope criteria for high-rise residential buildings rather than the prescriptive criteria for nonresidential buildings.
2. Hotel and motel guest rooms are not required to have economizer controls.
3. Guest rooms in hotel/motels are exempt from the lighting power density requirements. However, lighting must meet the residential requirements of §150 (k).
4. Each occupancy (other than guest rooms) in the hotel/motel must comply with the Nonresidential Lighting Standards.

5. For compliance with water heating requirements, use the residential compliance.

Performance Compliance

The rules for performance compliance are identical to the rules for complying for all other nonresidential and high-rise residential buildings. The area of each function of a hotel/motel is input into the program along with its corresponding envelope, mechanical and indoor lighting features. The Computer Software program will automatically calculate an energy budget for the standard design, and the proposed design's energy use.

1.7.9 Live-Work Spaces

Live-work buildings are a special case of mixed occupancy buildings, as they combine residential and nonresidential uses within individual units. In general, the low-rise or high-rise residential requirement (depending on the number of habitable stories) applies since these buildings operate (and therefore are conditioned) 24 hours per day. Lighting in designated workspaces is required to show compliance with the Nonresidential Lighting Standards (§146).

1.7.10 Unconditioned Space

Unconditioned space is neither directly nor indirectly conditioned, as defined in the previous section. Both the requirements for lighting and minimum skylight area apply to unconditioned space. Some typical examples of spaces that may be unconditioned:

- Enclosed parking structures
- Automotive workshops
- Enclosed entry courts or walkways
- Enclosed outdoor dining areas
- Greenhouses
- Loading docks
- Warehouses
- Mechanical/electrical equipment rooms

Keep in mind that these kinds of spaces are not always unconditioned. The specifics of each case must be determined. See Figure 1-1 to determine whether a space is unconditioned or conditioned.

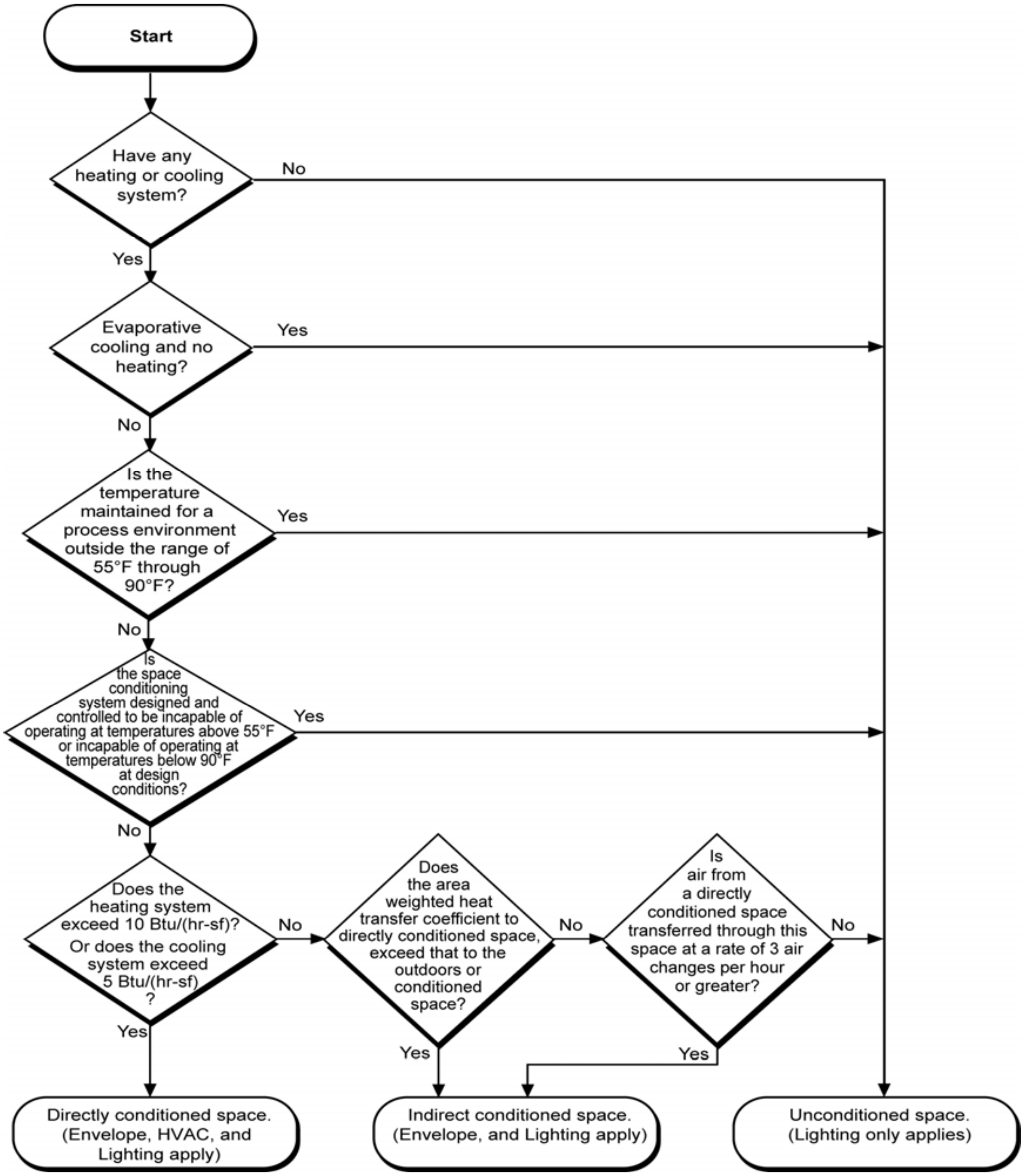


Figure 1-1 – Type of Conditioned Space and Scope of Compliance

1.7.11 Newly Conditioned Space

When previously unconditioned space becomes conditioned, the space is then considered an “addition” and all the building’s components must then comply as if it were a new building.

This situation has potentially significant construction and cost implications. For example, if an unconditioned warehouse is upgraded with a heating system, thus becoming conditioned space, the building envelope must comply with the current envelope requirements and the lighting system must be brought into conformance with the current lighting requirements, including mandatory wiring and switching. If the envelope has large windows, it is conceivable that some would have to be eliminated or replaced with more efficient windows. If the lighting system is inefficient, fixtures might have to be removed and new, more efficient fixtures installed.

This requirement can cause difficulty when an owner of a building seeks exemption from complying with the Standards by erecting a shell with no plans to condition it. For example, the owner of an office building obtains a permit for the structure and envelope, but wishes to leave the space conditioning and lighting improvements to the tenants. If that owner claims unconditioned status for that building, the owner does not have to demonstrate compliance with the envelope requirements of the Standards, but does have to demonstrate compliance with the lighting requirements. If at the time of permitting a tenant is not identified for a multi-tenant space, the tenant leased space lighting power allowances from Standards Table 146-F shall be used. As soon as the tenant applies for a permit to install the HVAC equipment, however, the envelope and any existing lighting to remain must then be brought into full compliance with the requirements for the occupancy designated at the time of the HVAC permit application. This is the only circumstance when systems, other than those subject to the current permit application, fall under the Standards. If the building was initially designed in a way that makes this envelope compliance difficult, the building envelope may require expensive alterations to bring it into compliance.

Many enforcement agencies require the owner to sign an affidavit at the time of the initial building permit for the shell, acknowledging the potential difficulties of future envelope or lighting compliance.

To minimize Standards compliance difficulties, the recommended practice is to demonstrate energy compliance at the time the envelope is built, and to demonstrate compliance for the lighting systems when lighting systems are installed.

1.7.12 New Construction in Existing Buildings

Tenant improvements, including alterations and repairs, may be considered new construction in an existing building. For example, the base building has been constructed, but the individual tenant spaces have not been completed. Tenant improvements can include work on the envelope, the mechanical, or the lighting systems. Whatever the case, the system or systems being installed are considered to be new construction, and must comply with some or all of the current Standards, depending on the extent of the changes (see following sections).

The only circumstance when systems other than those subject to the current permit application come under scrutiny is when the tenant improvement results in the conditioning of previously unconditioned space.

1.7.13 Alterations to Existing Conditioned Spaces

§149(b)

An alteration is any change to a building’s water heating system, space conditioning system, indoor lighting system, outdoor lighting system, sign, or envelope that is not an addition. Alterations or renovations to existing conditioned spaces have their own set of rules for energy compliance. They are covered in §149(b). Additions are discussed in §149(a).

In summary, the alteration rules are:

1. The Standards apply only to those portions of the systems being altered; untouched portions need not comply with the Standards.
2. If an envelope, indoor lighting, outdoor lighting, or sign lighting alteration increases the energy use of the altered systems, the alteration must comply with the current Standards.
3. Alterations must comply with the mandatory measures for the changed components.
4. New systems in the alteration must comply with the current Standards.
5. In an existing unconditioned building, outdoor lighting, or sign lighting system, altered lighting must meet mandatory measures for the changed lighting component.
6. Alterations that increase the connected lighting load or replace more than 50 percent of the lighting fixtures (counting existing and new fixtures only in the enclosed spaces where light fixture alterations are proposed) must meet current Standards. Replacement of parts of an existing lighting fixture, including installing new ballasts or lamps, without replacing the entire luminaires is not an alteration.
7. In an existing unconditioned building, where evaporative cooling is added to the existing unaltered envelope and lighting, does not need to be brought into compliance with current Standards.

The effect of these rules is that, in most cases, the existing systems (envelope and lighting) set the standard for the altered systems. For example, if the existing lighting system is changed but does not increase the connected lighting load, does not replace more than 50 percent of fixtures in the spaces where lighting changes are proposed, but meets the applicable mandatory measures, it complies. The same holds true for changes to the envelope: if the overall heat loss or heat gain is not increased and it meets its applicable mandatory measures, then it complies. Mechanical system alterations are governed primarily by the mandatory measures.

The alternative alteration rule is to make changes to the existing building so that the entire building (existing and alteration) complies with the performance approach of the current Standards. Keep in mind that, under the performance approach, credit is given only for systems that are actually changed in the current construction process.

Example 1-2

Question

An owner wants to add less than 50 ft² of new glazing in an old building. What are the applicable requirements for the new glazing?

Answer

Exception to §149(b)1Aiii exempts up to 150 ft² of added windows from the requirements §143(a)5, which includes the west-facing windows' limitations and U-factor requirements. The new glazing must still meet the RSHG requirements for the 30-40 percent of WWR of Table 143-B.

Example 1-3

Question

A building owner wants to change existing lighting fixtures with new ones. Do the Standards restrict the change in any way?

Answer

If more than 50 percent of the fixtures are replaced in the permitted space (excluding enclosed spaces where no new lighting fixtures are proposed), or the connected load is increased, the Standards will treat this as a new lighting system that must comply with §146. Any applicable mandatory requirement affected by the alteration applies, and the mandatory switching requirements would apply to the improved system if the circuiting were altered. Appliance Efficiency Regulations requirements for ballasts would also apply.

Example 1-4

Question

A building owner wants to rearrange some interior partitions and re-position the light fixtures in the affected rooms. Do the Standards apply to the work?

Answer

Each of the newly arranged rooms must have its own light switches. Since there is no change in the connected lighting load or the exterior envelope, only the mandatory light switching requirements would apply.

Example 1-5

Question

A building owner wants to rearrange some duct work and add some additional fan coils to an existing HVAC system to improve comfort. Do the Standards apply to the work?

Answer

There would be no change in the load on the system nor any increase in its overall capacity, so the Standards would not apply to the central system. Only the duct construction requirements apply to altered ducting.

Example 1-6

Question

A building owner wants to replace an existing chiller. No other changes will be made to the HVAC system. Do the Standards restrict the change in any way?

Answer

The mandatory efficiency requirements would govern the efficiency of the new chiller. The other parts of the system are unchanged and therefore unaffected by the Standards.

Example 1-7

Question

A building owner has a high ceiling space and wants to build a new mezzanine space within it. There will be no changes to the building envelope or to the central HVAC system. There will be new lighting installed. How do the Standards apply?

Answer

Since a mezzanine does not add volume, it is an alteration, not an addition. The existing systems are not affected unless they are altered. The new lighting must comply with all requirements of the Standards. The envelope is unchanged, so there are no requirements for it. The mechanical system duct work is simply extended without increase in system capacity, so only the duct construction and insulation requirements apply.

1.7.14 Additions

§149(a)

An addition is any change to a building that increases floor area and conditioned volume. Additions involve either the construction of new, conditioned space and conditioned volume, the installation of space conditioning in a previously unconditioned space, or the addition of unconditioned space. The mandatory measures and either the prescriptive or the performance requirements apply. For conditioned space the heating, lighting, envelope, and water heating systems of additions are treated the same as for new buildings. The only exception to this is if the existing mechanical system(s) are simply extended into the addition: Exception to §149(a). Refer above to Section 1.7.10 for further discussion of previously unconditioned space. Note that unconditioned additions need only comply with indoor, outdoor lighting, and sign lighting requirements of the Standards.

There are three options for the energy compliance of additions under the Standards:

Option 1 – Addition Alone

Treat the addition as a stand-alone building with adiabatic walls to conditioned space (§149(a)1 and §149(a)2Bi). This option can employ either the prescriptive or the performance approach. Adiabatic means the common walls are assumed to have no heat transfer between the addition and the adjacent conditioned space, and are ignored entirely.

Option 2 – Existing-Plus-Addition

Combine the existing building with the addition (§149(a)2Bii). This is a performance approach option only. Under this scenario, the proposed energy use is calculated based on existing building features that remain unaltered, and all alterations (actual values of the proposed alterations), plus the proposed addition. The standard (allowed) budget is calculated based on the existing building features that remain unaltered, and all proposed alterations modeled to meet the requirements of §149(b)2B (these are generally mandatory or prescriptive requirements for mechanical, envelope, and lighting systems), plus the addition modeled to meet the requirements of §141. If the proposed energy use is less than or equal to the standard budget, then the building complies. The standard design for any alterations to existing lighting and mechanical systems must meet the requirements for altered systems in §149(b).

This option will generally work to ease the energy requirements of the addition only if there are energy improvements to the existing building. It does allow the designer to make a relatively energy inefficient addition comply.

Option 3 – Whole Building

The existing structure combined with the addition can be shown to comply as a whole building with all requirements of the current Standards for new construction for envelope, lighting and mechanical. This method is only practical if the existing building is, or will be improved to be, consistent with current Standards requirements.

Example 1-8

Question

A restaurant adds a greenhouse-style dining area with large areas of glazing. It is directly conditioned space. How can it comply with the Standards?

Answer

Because of its large glass area, it will not comply on its own. By making substantial energy improvements to the existing building (lighting, mechanical or other envelope features), or by upgrading the existing building so that the entire building meets the requirements for new construction, it is possible for the combined building to comply. The performance approach would be used to model the combined existing/new building.

1.7.15 Changes of Occupancy

A change of occupancy alone does not require any action under the Standards. If changes (alterations) are made to the building, however, then the rules for alterations or additions apply (see Sections 1.7.13 and 1.7.14).

If the change in occupancy involves converting from a residential to a nonresidential occupancy or vice versa (changes defined by the California Building Code occupancy definitions), then the Standards applicable to the new occupancy would govern any alterations made to the building. For example, if a home is converted to law offices, and a new lighting system is installed, the Nonresidential Lighting Standards would apply. If a new HVAC system is installed, all the nonresidential HVAC requirements would have to be met.

If no changes are proposed for the building, it is advisable to consider the ventilation requirements of the new occupancy. For example, if a residence is converted to a hair salon, the ventilation rates of the building should be considered. With new sources of indoor pollution, the existing residential ventilation rates would likely not be adequate for the new uses. However, no change is required by the Standards.

1.7.16 Repairs

A repair is the reconstruction or renewal of any part of an existing building for the purpose of its maintenance. Repairs shall not increase the preexisting energy consumption of the required component, system, or equipment.

1.7.17 Scope Concepts and Definitions

This section explains the definitions and terms necessary for understanding the scope and application of the Nonresidential Standards. In most cases, a careful reading of these definitions will resolve questions of interpretation. See also the Glossary in Reference Joint Appendix JA1.

Building is any structure or space that is covered by §100. By this definition, a building is not necessarily a complete physical structure. For the Standards, a building in this sense can be a lighting system recircuiting project, because this would require an electrical permit.

Conditioned Floor Area (CFA) is the floor area (in ft^2) of enclosed conditioned space on all floors of a building, as measured at the floor level of the exterior surfaces of exterior walls enclosing the conditioned space. Once the spaces that are directly or indirectly conditioned are identified, then it is possible to calculate the conditioned floor area of the building. This number is used for various calculation purposes in complying with the Standards. The CFA is generally calculated from dimensions on the floor plans of the building. It is measured from the outside surfaces of exterior walls, with the dimensions taken at floor level. This definition helps mitigate any complexity from sloping walls, bay windows and other unique building details.

Conditioned Space is space in a building that is either directly conditioned or indirectly conditioned. In most circumstances it is obvious whether a space is conditioned or unconditioned. There are, however, special circumstances that require a closer look at the definitions of directly and indirectly conditioned space.

Directly Conditioned Space is an enclosed space that is provided with wood heating, is provided with mechanical heating that has a capacity exceeding 10 Btu/(hr. × $ft.^2$), or is provided with mechanical cooling that has a capacity exceeding 5 Btu/(hr. × $ft.^2$), unless the space-conditioning system is designed for a process space. (See “Process space”).

Space-conditioning system may consist of but is not limited to chiller/compressor, air handler unit, cooling and heating coils, air and water cooled condenser, economizer, and the air distribution systems, which provide either collectively or individually heating, ventilation, or cooling within or associated with conditioned spaces in a building.

Process Space is a space that is thermostatically controlled to maintain a process environment temperature less than 55°F or to maintain a process environment temperature greater than 90°F for the whole space that the system serves, or is a space within a space-conditioning system designed and controlled to be incapable of operating at temperatures above 55°F or incapable of operating at temperature below 90°F unless the space conditioning is designed and controlled to be incapable of operating at temperatures above 55°F or incapable of operating at temperatures below 90°F at design conditions. These definitions contain several key ideas central to the Standards. First, mechanically heated or mechanically cooled space (discussed below) may be conditioned (i.e., it does not have to be both heated and cooled). Second, it depends on how much heating or cooling is provided to determine if the space is directly conditioned. It is not uncommon for an otherwise unheated space (such as a warehouse) to have a small area with a unit heater, such as a desk on the loading dock. This usually does not make the entire structure a heated space. The total quantity of heating provided to the space has to exceed 10 Btu/(hr-ft^2). Similar logic applies to a mechanical cooling system; if it provides more than 5 Btu/(hr-ft^2), it means the space is directly conditioned. Third, it matters at what temperature the space is controlled. Many spaces, such as refrigerated warehouses, are conditioned but are deliberately kept at very hot or cold temperatures. The space conditioning is not for human comfort but to serve the needs of some process, such as preventing vegetables from spoiling. If the space conditioning system is specifically designed and operated to maintain a temperature that is not within the range of 55°F through 90°F and is thermostatically controlled not to operate within this temperature range, then the space is not directly conditioned. Note that these spaces other than refrigerated storage are treated like unconditioned spaces and therefore must meet the lighting requirements.

Enclosed Space is space that is substantially surrounded by solid surfaces such as walls, ceilings or roofs, doors, fenestration areas, and floors or ground. Spaces that are not enclosed are spaces that are open to the outdoors, such as covered walkways, parking structures that are open or have fenced mechanical enclosures.

Entire Building is the ensemble of all enclosed space in a building, including the space for which a permit is sought, plus all existing conditioned and unconditioned space within the structure. This definition affects lighting compliance within the complete building method.

Habitable Story is a story that contains space in which humans may work or live in reasonable comfort, and that has at least 50 percent of its volume above grade. This definition is important in distinguishing between high-rise and low-rise residential buildings, which are covered by different Standards and are described in separate manuals. Basement floors with more than 50 percent of their volume below grade are not counted as habitable stories regardless of their actual use. In buildings on sloping ground, the calculation of volume below grade can become cumbersome, but for most buildings it will be obvious whether the floor is at least 50 percent above grade.

Indirectly Conditioned Space is enclosed space including, but not limited to, unconditioned volume in atria, that (1) is not directly conditioned space; and (2) either (a) has an area-weighted heat transfer coefficient to directly conditioned space exceeding that to the outdoors or to unconditioned space, or, (b) is a space through which air from directly conditioned spaces is transferred at a rate exceeding three air changes per hour. This definition is important because the Standards treat indirectly conditioned space the same as conditioned space; in other words, indirectly conditioned spaces must meet the requirements of the Standards. As a guide, professional judgment should be exercised when determining whether a space is indirectly conditioned, especially as it relates to door placement in the space. When an enclosed space that is not directly conditioned has openings only into a conditioned space, it should be considered indirectly conditioned. Likewise, when an enclosed space that is not directly conditioned has openings only to the outdoors, it should be considered to be unconditioned. When enclosed spaces that are not directly conditioned have openings both to the outdoors and to conditioned spaces, an evaluation of relative heat transfer and air change rate (UA) should be used to determine the status of the space. A typical example of an indirectly conditioned space might be the stairwell of a high-rise office building. The first part of the definition is that it not be directly conditioned. This is not uncommon in stairwells. The second part of the definition is that it be provided with space conditioning energy from a space that is directly conditioned. This can be done in one of two ways. The first is by conduction heat transfer. If heat is transferred in from directly conditioned space (e.g., through the walls of the stairwell) faster than it is transferred out to the unconditioned surroundings, then the space is considered to be indirectly conditioned. The second way is for the space to be ventilated with air from directly conditioned spaces. For example, if exhaust hoods draw air through a kitchen from the dining room at a rate exceeding three air changes per hour, then the kitchen will be considered indirectly conditioned space.

Mechanical Cooling is lowering the temperature within a space using refrigerant compressors or absorbers, desiccant dehumidifiers, or other systems that require energy from depletable sources to directly condition the space. In nonresidential, high-rise residential, and hotel/motel buildings, cooling of a space by direct or indirect evaporation of water alone is not considered mechanical cooling (see also “directly conditioned space”). For buildings covered by this manual, evaporative cooling is not considered mechanical cooling. This means, for example, that a warehouse with only evaporative coolers does not meet the definition of mechanical cooling. Nonresidential buildings with evaporate cooling are unconditioned spaces.

Mechanical Heating is raising the temperature within a space using electric resistance heaters, fossil fuel burners, heat pumps, or other systems that require energy from depletable sources to directly condition the space. If the only source of the heat is a nondepletable source, then the system is not considered mechanical heating. Nondepletable sources would include solar collectors, geothermal sources, and heat recovered from a process, such as refrigeration chillers.

Unconditioned Space is enclosed space within a building that is not directly conditioned or indirectly conditioned space. Unconditioned spaces are required to meet the Indoor Lighting Standards.

High-Rise Residential is a building, other than a hotel/motel, of occupancy group R-1 with four or more habitable stories. California Building Code Occupancy Group R-1 includes apartment houses, convents and monasteries (accommodating more than 10 persons). (See definition of Unconditioned Space above). If a building has four or more habitable stories, any residential occupancy in the building is considered high-rise residential, regardless of the number of stories that are residential.

Hotel/Motel is a building or buildings incorporating six or more guest rooms or a lobby serving six or more guest rooms, where the guest rooms are intended or designed to be used, or which are used, rented, or hired out to be occupied, or which are occupied for sleeping purposes by guests, and all conditioned spaces within the same building envelope. Hotel/motel also includes all conditioned spaces that are (1) on the same property as the hotel/motel, (2) served by the same central HVAC system as the hotel/motel, and (3) integrally related to the functioning of the hotel/motel as such, including, but not limited to, exhibition facilities, meeting and conference facilities, food service facilities, lobbies and laundries. A key part of this definition is that the hotel/motel includes all spaces within the same building envelope as the lobby or the guest rooms. This is because hotel/motel buildings are generally multi-purpose facilities. They may include such diverse spaces as restaurants, auditoriums, retail stores, offices, kitchens, laundries and swimming pools. All are treated as hotel/motel spaces. For hotels/motels with five or less guest rooms, low-rise residential compliance should be used instead of nonresidential compliance. All hotels/motels should use the low-rise residential water heating calculation approach.

This concept extends to other buildings associated with the hotel/motel that pass the three tests:

- Same property.
- Same central HVAC system.
- Integrally related to the hotel/motel.

Mixed Occupancies. The Standards apply to mixed occupancies in the same way they apply to single occupancy buildings. The Residential Standards apply to applicable occupancies; the Nonresidential Standards apply to appropriate occupancies. If these two types occur in the same building, the building must be treated as two separate buildings for purposes of energy compliance, with each part meeting its applicable requirements. An exception provides that if one occupancy makes up 80 percent of the building, the entire building may comply with the envelope and mechanical provisions of the dominant occupancy. The interior lighting requirements and mandatory measures for the actual occupancy will apply.

Other Occupancy Definitions. There are over 35 additional occupancy definitions in the Standards. They are used primarily to assign lighting area categories. Refer to the Glossary in Reference Joint Appendix JA1 for these definitions (found alphabetically under “Occupancy Type)”.

Example 1-9

Question

If a space were 1,000 ft², how large would the heating system have to be to make the space directly conditioned?

Answer

The heating system would have to be larger than 10 Btu/(hr-ft²) x 1,000 ft² = 10,000 Btu/hr output to meet the definition of directly conditioned space.

Example 1-10

Question

A water treatment plant has a heating system installed to prevent pipes from freezing. The heating system exceeds 10 Btu/(hr-ft^2) and operates to keep the space temperature from falling below 50°F. Is this plant directly conditioned?

Answer

Not if the heating system is sized to meet the building load at 50°F and is thermostatically controlled to prevent operating temperatures above 50°F. The definition of directly conditioned space excludes spaces that have space conditioning designed and controlled to be incapable of operating at temperatures above 55°F at design conditions. Under these conditions, the space is not directly conditioned.

Example 1-11

Question

A manufacturing facility will have space cooling to keep the temperature from exceeding 90°F. If the thermostat will not allow cooling below 90°F, is this facility directly conditioned?

Answer

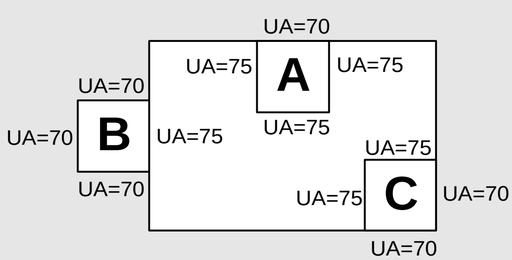
No, this facility is not directly conditioned. The definition of directly conditioned space excludes spaces where the space conditioning system is designed and controlled to be incapable of operating at temperatures below 90°F at design conditions.

Example 1-12

Question

The accompanying sketch shows a building with three unconditioned spaces (none has a direct source of mechanical heating or cooling). The air transfer rate from the adjacent conditioned spaces is less than three air changes per hour. The area weighted heat transfer coefficients of the walls (UA) are shown on the sketch. The roof/ceiling area weighted heat transfer coefficients (UA) for each of the three unconditioned spaces is 90 Btu/Hr -°F.

Are any of these spaces indirectly conditioned?



Answer

Because the air change rate is low, we evaluate each space on the basis of heat transfer coefficients through the walls and roof. It is further assumed that the floors are adiabatic. Therefore, the heat transfer will be proportional to the area weighted heat transfer coefficients of the walls and roof/ceilings.

SPACE A: The area weighted heat transfer coefficient to directly conditioned space is 3 x (75 Btu/Hr-°F) = 225 Btu/Hr-°F. The area weighted heat transfer coefficient to the outdoors or to unconditioned space is 70 Btu/Hr-°F + 90 Btu/Hr-°F = 160 Btu/Hr-°F. Since the heat transfer coefficient from Space A to the conditioned space is greater than heat transfer coefficient from Space A to outside, Space A is considered indirectly conditioned.

SPACE B: The area weighted heat transfer coefficient to directly conditioned space is 75 Btu/Hr-°F. The area weighted heat transfer coefficient to the outdoors or to unconditioned space is (3 x 70 Btu/Hr-°F) + 90 Btu/Hr-°F = 300 Btu/Hr-°F. Since the heat transfer coefficient from Space B to the conditioned space is less than the heat transfer coefficient from Space B to outside, Space B is considered unconditioned.

SPACE C: The area weighted heat transfer coefficient to directly conditioned space is (2 x 75 Btu/Hr-°F = 150 Btu/Hr-°F. The area weighted heat transfer coefficient to the outdoors or to unconditioned space is (2 x 70 Btu/Hr-°F) + 90 Btu/Hr-°F = 230 Btu/Hr-°F. Since the heat transfer coefficient from Space C to the conditioned space is less than the heat transfer coefficient from Space C to outside, Space C is considered unconditioned.

Example 1-13

Question

In a four-story building, first floor is retail, second and third floors are offices, and the fourth floor is residential (as defined in the CBC). Is the residential space high-rise or low-rise?

Answer

It is a high-rise residential space. Even though there is only one floor of residential occupancy, the building has four habitable stories, making it a high-rise building.

1.8 About the Standards

History

Section 25402 of the Public Resources Code

The Legislature adopted the Warren-Alquist Act which created the California Energy Commission (Energy Commission) in 1975 to deal with energy-related issues, and charged the Energy Commission with the responsibility to adopt and maintain Energy Efficiency Standards for new buildings. The first Standards were adopted in 1978 in the wake of the Organization of Petroleum Exporting Countries (OPEC) oil embargo of 1973.

The Act requires that the Standards be cost effective “when taken in their entirety and amortized over the economic life of the structure.” It also requires that the Energy Commission periodically update the Standards and develop manuals to support the Standards. Six months after publication of the manuals, the Act directs local building permit jurisdictions to withhold permits until the building satisfies the Standards.

The so-called “First Generation” Standards for nonresidential buildings took effect in 1978, and remained in effect for all nonresidential occupancies until the late

1980s, when the “Second Generation” Standards took effect for offices, retail and wholesale stores.

The next major revision occurred in 1992 when the requirements were simplified and consolidated for all building types. At this time, major changes were made to the lighting requirements, the building envelope and fenestration requirements, as well as the HVAC and mechanical requirements. Structural changes made in 1992 set the way for national standards in other states.

The Standards went through minor revisions in 1995, but in 1998, the lighting power limits were reduced significantly, because at that time, electronic ballasts and T-8 lamps were cost effective and becoming common practice in nonresidential buildings.

The California electricity crisis of 2000 resulted in rolling blackouts through much of the State and escalating energy prices at the wholesale market, and in some areas of the State in the retail market as well. The Legislature responded with AB 970, which required the Energy Commission to update the Energy Efficiency Standards through an emergency rulemaking. This was achieved within the 120 days prescribed by the Legislature and the 2001 Standards (or the AB 970 Standards) took effect mid-year 2001. The 2001 Standards included requirements for high performance windows throughout the State, more stringent lighting requirements and miscellaneous other changes.

The Public Resources Code was amended in 2002 through Senate Bill 5X to expand the authority of the Energy Commission to develop and maintain standards for outdoor lighting and signs. The Standards covered in this manual build from the rich history of Nonresidential Energy Standards in California and the leadership and direction provided over the years by the California Legislature.

The 2008 Standards were expanded to include refrigerated warehouses and steep-sloped roofs for the first time.

Example 1-14

Question

If a building is LEED certified does it still need to meet the 2008 Building Energy Efficiency Standards?

Answer

Yes.

1.8.1 California Climate Zones

Since energy use depends partly upon weather conditions, which differ throughout the State, the Energy Commission has established 16 climate zones representing distinct climates within California. These 16 climate zones are used with both the Residential and the Nonresidential Standards. The boundaries are shown in Figure 1-2 and detailed descriptions and lists of locations within each zone are available in Reference Joint Appendix JA2.

Cities may occasionally straddle two climate zones. In these instances, the exact building location and correct climate zone should be verified before any calculations are performed. If a climate zone boundary line splits a single building, it must be designed to the requirements of the climate zone in which 50 percent or more of the building is contained.

Figure 1-2 – California Climate Zones

Five basic steps are involved:

1. Design the building with energy efficiency measures that are expected to be sufficient to meet the energy budget. The prescriptive approach requirements provide a good starting point for the development of the design.

2. Demonstrate that the building complies with the mandatory measures.
3. Use an approved calculation method (state-approved energy compliance software.)
4. Model the energy consumption of the building using the proposed features to create the proposed energy budget. The model will also automatically calculate the allowed energy budget for the proposed building.
5. If the proposed energy budget is no greater than the allowed energy budget, the building complies.