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BUILDING ENERGY EFFICIENCY STANDARDS

1987 Edition

1988 SUPPLEMENT

For historical reference
Current Title 24 Standards are available at:
<http://www.energy.ca.gov/title24/>

December 1987

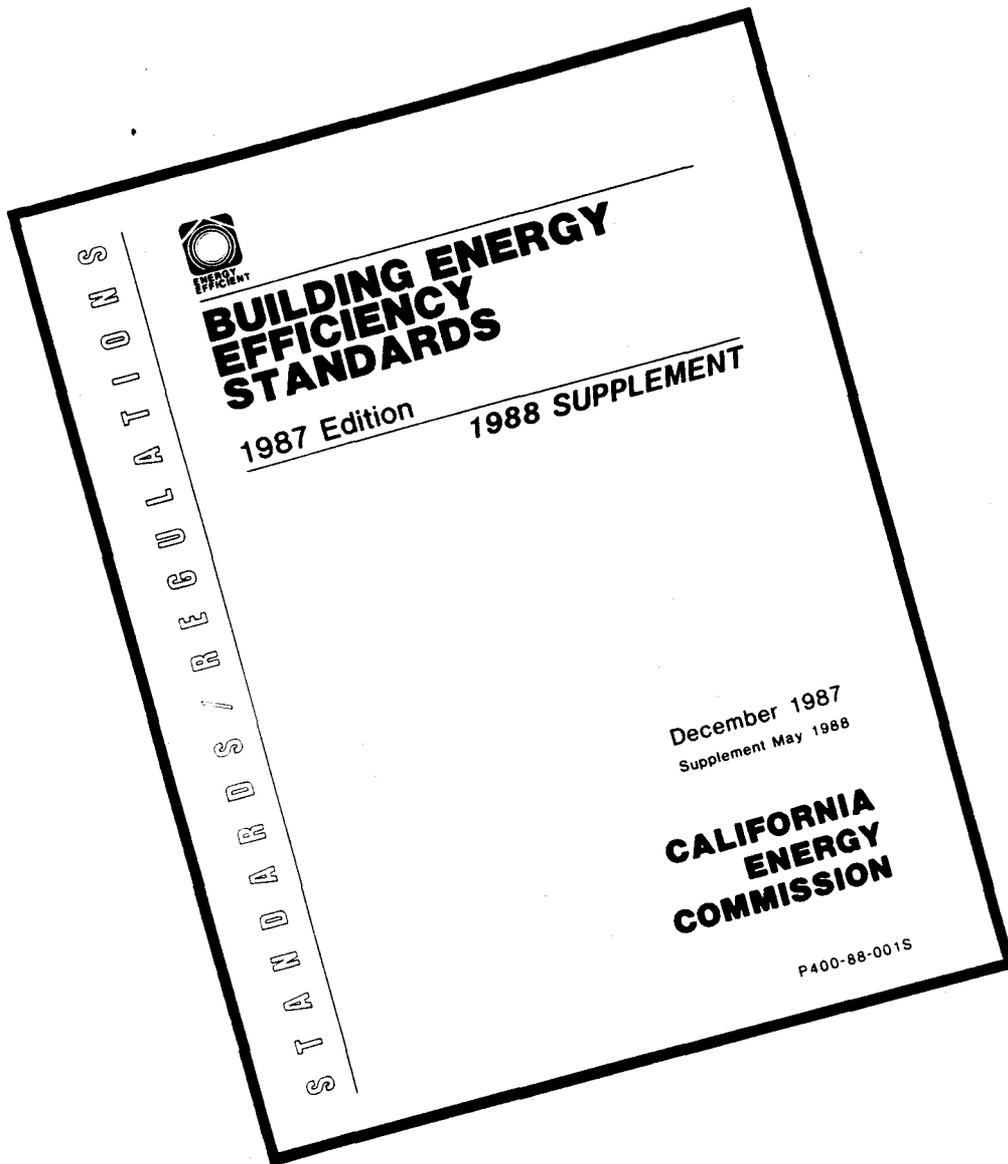
Supplement May 1988



George Deukmejian, Governor

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ENERGY
COMMISSION**

P400-88-001S



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This update to the energy efficiency standards specifies changes to the standards, which become effective July 1, 1988, that could result in differences in compliance. Changes which consist of correcting typographical errors, modifying terminology without changing substance, or changes that can be described in a general fashion, may not be included in this update in the form of "express terms". These types of changes are described in general terms, and references to the affected sections are given. The complete set of detailed changes will be incorporated in the 1988 edition of the Building Energy Efficiency Standards which will be available within a few months.

We believe that these "emergency" changes will make compliance and enforcement clearer for mixed occupancies and individual tenants in shell buildings, and improve the standards for all parties involved.

The primary changes between this update (1988 edition) and the 1987 edition are noted below.

ADDITIONS, ALTERATIONS, & REPAIRS

- 1) Section 2-5301(d), describing the requirements for additions, alterations, and repairs in nonresidential buildings, has been revised to reflect changes in lighting control and HVAC requirements. The lighting control requirements in Section 2-5319(a) and (b), which specify at least one readily accessible manually-operated switch in all enclosed rooms, are required for all alterations. The HVAC requirements of new buildings are required for some HVAC alterations. The "grandfather" clause for first tenant improvements in shell buildings, permitted for conditioned use, has been codified.

EARLY COMPLIANCE WITH SECOND GENERATION STANDARDS

- 2) First generation nonresidential occupancies (i.e., all nonresidential occupancies except for offices and stores) will be allowed to comply with the "Second Generation" standards adjusted for lighting. The applicant may comply with the Office Alternative Component Packages A, B, or C or the office budgets (using office assumptions and weather/climate data) after adjustment for the allowed lighting.

BUDGET PARAMETER CHANGE FOR "SECOND GENERATION" NONRESIDENTIAL STANDARDS

- 3) The budget columns are now a function of "conditioned area-to-conditioned perimeter ratio" rather than "conditioned cross-sectional area" and allow tenant-by-tenant or whole building compliance with the budgets. This new budget column determinant is more flexible and realistic for a wide variety of building shapes.

"SECOND GENERATION" ALTERNATIVE HVAC COMPLIANCE CODIFIED

- 4) The alternative HVAC compliance method for second generation nonresidential standards has been codified. This method allows HVAC systems without electric heat to meet sizing and selection criteria in lieu of the HVAC Power Indices.

The terms "first generation residential occupancies", "second generation residential occupancies", "first generation nonresidential occupancies", and "second generation nonresidential occupancies" are defined in Section 2-5302, Definitions, and are used throughout the text to define the application of various sections of the standards. Previously, the description of these occupancies were used inconsistently within the standards resulting in confusion and unnecessary conflict. Also note that the new definitions include a four story single family home as a "second generation residential occupancy" and a condominium in a four story structure as a "first generation residential occupancy".

In Section 2-5301(a), Exception No. 3, part of the "Scope" was repealed since it was interpreted as applying only to buildings where construction began prior to January 1, 1978, hence was considered obsolete.

Minor corrections in terminology were made in Sections 2-5304(c), 2-5304(d)2., Equation 2-53B in Section 2-5304(d)4.C.(5), 2-5313(c), Equations 2-53E and F in Section 2-5325, and Equations 2-53G and H in Section 2-5326. These corrections or changes have no substantive effect on the way these standards are currently enforced.

References to other documents are updated. Where the terms UMC or UBC are used in the text, they now refer to the 1988 editions in accordance with the definition of "UBC" and "UMC" in Section 2-5302. These references were changed in Sections 2-5311(b) and 2-5313(c). A reference to the ASHRAE Handbook was updated to Chapter 57 of the 1987 ASHRAE Handbook, HVAC Systems & Application Volume in Sections 2-5318(a)2. and 2-5318(b)1. References to manuals for the Energy Standards were updated in Section 2-5304(d)4.B.(3). A reference to a listing of "degree days" in Table 2-53F, Section 2-5313 was corrected to the 1983 Guide to Envelope Design (P400-83-035). Cross-references to other sections of the standards were added to improve clarity. Such added cross-references were added in Sections 2-5316(c)3., 2-5341(b)1., 2-5342, and 2-5342(d)2.A.

Obvious typographical errors that made the language meaningless were corrected in Sections 2-5304(c), 2-5318(a)3., 2-5319(c), and 2-5319(d). Other typographical errors may be interpreted as changes in the meaning of the regulations. These changes are included in the update to avoid further confusion regarding these Sections. Such changes are found in Sections 2-5319(i), 2-5342(d)2. p.99, and Tables 2-53WA1 through 2-53WA16.

In a similar vein, specific clarifications were made in the standards to conform to staff advice that may affect enforcement. The effect of these modifications is quite limited in scope, but may still be important. In Section 2-5304(d)4.b(1), p.30, "humidity criteria" were deleted from the assumed operating conditions "since no criteria were used in the budgets. In Section 2-5318(d)1., the requirements for pool heaters was clarified to apply to all pool heaters built "in conjunction with a building of occupancy R" rather than "in a building of occupancy R" to conform to the original intent of this requirement. Section 2-5319(h) was clarified to indicate that valance and display lighting for stores must be circuited and switched on circuits of 20 amps or less. The original wording could have been interpreted as requiring only circuits of 20 amps.

Other changes not discussed above may have the "express terms" of the language included with this update.

PLEASE NOTE: Other changes adopted between 1985 and 1987, and already published in the 1987 Edition (P400-88-001) of the standards will become effective JULY 1, 1988. These changes include, but are not limited to:

- 1) "SECOND GENERATION" STANDARDS FOR RETAIL & WHOLESALE STORES BECOME MANDATORY.
- 2) "SECOND GENERATION" LIGHTING IS REQUIRED FOR ALL NONRESIDENTIAL OCCUPANCIES (EXCEPT FOR "CLASSROOMS IN SCHOOLS" WHICH MAY USE "EQUIVALENT SPHERE ILLUMINATION" CALCULATIONS TO DETERMINE COMPLIANCE).
- 3) THE OFFICE BUDGETS HAVE BEEN CORRECTED, EFFECTIVELY LOWERING THE ALLOWANCES FOR PERIMETER DOMINATED SPACES BUT ALLOWING MORE REALISTIC VENTILATION ASSUMPTIONS.
- 4) SKYLIGHTS ARE ALLOWED IN ALL ALTERNATIVE COMPONENT PACKAGES FOR OFFICES AND STORES, AND LIGHTING POWER COMPLIANCE IS MORE FLEXIBLE IN ALL PACKAGES.

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THE FOLLOWING PAGES ARE DESIGNED AS REPLACEMENT OR INSERT PAGES
INTO THE 1987 EDITION OF THE BUILDING ENERGY EFFICIENCY STANDARDS,
EXCEPT FOR THE ALTERNATIVE COMPONENT PACKAGES (ACPs) AT THE END
WHICH ARE TYPICAL EXAMPLES OF CHANGES THAT OCCUR IN 48 ACP TABLES.

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Chapter 2-53
ENERGY CONSERVATION IN NEW BUILDING CONSTRUCTION
ENERGY CONSERVATION STANDARDS--GENERAL PROVISIONS

Scope

Sec. 2-5301.

- (a) General. Chapter 2-53 establishes energy efficiency standards for buildings that are heated or mechanically cooled and for which an application for a building permit or renewal of an existing permit is filed on or after the effective date of the provisions. Chapter 2-53 also applies to buildings constructed by a governmental agency.

EXCEPTIONS: The following building types need not comply with Chapter 2-53:

EXCEPTION NO. 1: Qualified historical buildings, to the extent provided under the State Historical Building Code (Title 24, Part 8).

EXCEPTION NO. 2: Buildings in which no energy for space heating, space cooling, water heating, or lighting is derived from depletable sources.

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- (b) All Buildings. Sections 2-5301, 2-5302, 2-5311, and 2-5313 apply to all buildings.

(c) New Buildings.

1. Sections 2-5303, 2-5304, and 2-5312 through 2-5319 apply to new buildings of Uniform Building Code groups A, B, E, H, and R occupancies as described in Table No. 5-A and other sections of the Uniform Building Code.

EXCEPTION: Buildings of occupancy group R need not comply with Sections 2-5316(c) or 2-5319.

2. Sections 2-5321 through 2-5333 apply to first generation nonresidential occupancies in new buildings.
3. Sections 2-5341 through 2-5343 apply to second generation nonresidential occupancies in new buildings.
4. Sections 2-5351 and 2-5352 apply to second generation residential occupancies in new buildings.

EXCEPTION: Seasonally occupied agricultural housing limited by state or federal agency contract to occupancy not more than 180 days in any calendar year need not comply with the provisions of Section 2-5351.

5. The provisions of Sections 2-5361 through 2-5364 apply only to first generation residential occupancies in new buildings.

(d) New Construction in Existing Buildings:

1. Equipment, materials, and systems newly installed in conjunction with additions or alterations shall comply with the mandatory features indicated in Table 2-53B for the applicable occupancy type(s).

EXCEPTION: Alterations to lighting systems that do not involve replacement of more than half of the lineal footage of the wiring of a given circuit and that do not increase the connected power load of the existing lighting system need not comply with Section 2-5319, subsections (c), (d), (e), (f), (g), (h) and (i) for the luminaires served by that circuit.

2. Alterations which create conditioned space and all additions shall meet either A or B below.

A. Prescriptive Approach.

- (1) For first generation residential occupancies, the envelope, and newly installed HVAC and domestic hot water systems shall meet the requirements of Section 2-5362 through 2-5364.
- (2) For second generation residential occupancies, ceiling, wall, and floor insulation and glazing U-value and shading shall meet the requirements of Alternative Component Package A for the appropriate climate zone in Tables 2-5321 through 2-5326 in Section 2-5351(f), and all the requirements for Sections 2-5352(b) Loose Fill Insulation, 2-5353(d) Installation of Fireplaces, 2-5352(f) Vapor Barriers, and 2-5352(j) Lighting; and shall have a maximum total glazing area of 16 percent of the newly conditioned floor area plus the glazing area that was removed from the existing building because of the addition. Space conditioning equipment installed in conjunction with an addition or alteration that increases conditioned space shall meet the requirements of 2-5352(g) Space Conditioning Equipment Sizing and 2-5352(h) Setback Thermostats. Water heating equipment installed in conjunction with an addition or alteration that increases conditioned space shall meet the requirements of 2-5352(i) Water Heating Equipment.
- (3) For first generation nonresidential occupancies, the envelope, lighting, and newly installed HVAC systems shall meet the requirements of Section 2-5321 through 2-5333.
- (4) For second generation nonresidential occupancies, the envelope, lighting, and newly installed HVAC systems shall meet the requirements of Section 2-5342 and 2-5343.

EXCEPTION [to Section 2-5301(d)2.A]: When heating, cooling, or domestic hot water to an addition are provided by expanding existing systems, the existing systems and equipment need not comply with Chapter 2-53.

B. Performance Approach.

- (1) Performance calculations shall meet the requirements of Sections 2-5304(d) and the performance section(s) indicated in Table 2-53B for the applicable occupancy type(s).
- (2) The addition or alteration complies with the performance approach if either
 - a. the addition or altered space meets the appropriate energy budget alone, or
 - b. the energy efficiency of the existing building is improved such that the source energy consumption of the improved existing building and the addition is equal to or less than that of the unimproved existing building, as shown by an approved calculation method, plus an addition that complies with the applicable energy budget.

EXCEPTION NO.1 [to Section 2-5301(d)2.]: Any building constructed before January 1, 1978, need not comply with Section 2-5301(d)2., if the building permit applicant demonstrates to the satisfaction of the enforcement agency that the cost of compliance would exceed the value of the resulting energy savings, amortized over the economic life of the alteration or addition.

EXCEPTION NO.2 [TO Section 2-5301(d)2.]: Hotel alterations that are not additions need not comply with Section 2-5301(d)2.

3. Alterations to nonresidential occupancies in buildings required to have a certificate of compliance in accordance with Title 20, Section 1403(a)2.A., that do not create conditioned space and that do not involve a change in occupancy, shall demonstrate that the alterations are consistent with the features previously used to demonstrate compliance on the certificate of compliance. Alternatively, the applicant may demonstrate compliance by showing compliance for the building as a whole and establishing a new certificate of compliance for the building.
4. All alterations to nonresidential occupancies not subject to Section 2-5301(d)3 that do not create conditioned space shall meet the requirements for the specific systems or components altered as specified below: (Occupancy types referenced below are those applicable to the revised or altered space).
 - A. Alterations to the building envelope shall not increase the overall heat gain of the building as measured by the overall thermal transfer value ($OTTV_0$) and the overall heat loss of the building as measured by the overall U-value ($U_{overall}$) of the existing building envelope or shall meet the building envelope requirements for Alternative Component Packages A for low rise offices irrespective of the actual occupancy. The overall thermal transfer value ($OTTV_0$) and the overall U value ($U_{overall}$) and their calculation are described in Sections 2-5324 to 2-5326.

2-5301(d)-(e)

B. New HVAC systems shall meet the requirements of Sections 2-5327 to 2-5332 for first generation occupancies and Section 2-5342(e) for second generation occupancies.

C. Alterations to existing lighting systems shall meet the requirements of Section 2-5333 for classrooms in schools or 2-5342(d) for other spaces or tasks or shall not increase the connected load of existing lighting systems.

EXCEPTION NO. 1 [to Section 2-5301(d)4.]: When heating, cooling, or domestic hot water for an alteration or an addition are provided by expanding existing systems, the existing systems and equipment need not comply with Chapter 2-53.

EXCEPTION NO. 2 [to Section 2-5301(d)4.]: Any building constructed before January 1, 1978, need not comply with Section 2-5301(d)4 if the building permit applicant demonstrates to the satisfaction of the enforcement agency that the cost of compliance would exceed the value of the resulting energy savings, amortized over the economic life of the alteration or repair.

5. Repairs. Repairs shall not increase the pre-existing energy consumption of the repaired component, system, or equipment of a nonresidential building.

6. Any addition, alteration, or repair may comply with the requirements of Chapter 2-53 by meeting the requirements for new buildings for the building as a whole.

EXCEPTION: [to Section 2-5301(d)] The first tenant improvements for unoccupied spaces in a building permitted for a conditioned use may comply with the standards in effect at the time of application for the permitted conditioned use until said space in the permitted building has been occupied at least once. Alterations to occupied spaces currently or previously occupied, or undergoing a change in occupancy must comply with current standards.

(e) Mixed Occupancy. This subsection applies to new buildings and to new construction in existing buildings of occupancies A, B, E, H, and R. When a building is designed and constructed for more than one type of occupancy, the space for each occupancy shall meet the provisions of Chapter 2-53 applicable to that occupancy, if a prescriptive compliance approach is used, and if a performance compliance approach is used, Section 2-5304(d)3 shall be met.

EXCEPTION: The entire building may comply with the provisions applicable to one of the occupancies in the building if all other occupancies combined total less than 1,000 square feet and less than 30 percent, of the conditioned floor area of the building, or if all other occupancies constitute less than 10 percent of the conditioned floor area of the building.

- (f) **Administrative Requirements.** Administrative requirements relating to permit requirements, enforcement by the California Energy Commission locally adopted energy standards, interpretations, claims of exemption, approved calculation methods, and rights of appeal are specified in California Administrative Code, Title 20, Sections 1401-1410.
- (g) **Certification Requirements for Manufactured Devices.** Chapter 2-53 limits the use of manufactured devices to only those that have been certified by their manufacturer to meet or exceed minimum specifications or efficiencies adopted by the Commission. Certification requirements apply to the following manufactured devices:
1. Insulating materials (Section 2-5311).
 2. Refrigerators, refrigerator-freezers, and freezers (Section 2-5314(a)).
 3. Room air conditioners (Section 2-5314(a)).
 4. Central air conditioning heat pumps and other central air conditioners (Section 2-5314(a)).
 5. Gas space heaters (Section 2-5314(a)).
 6. Other heating and cooling equipment (Section 2-5314(b)).
 7. Water heaters (Section 2-5314(a)).
 8. Plumbing fittings (Section 2-5314(a)).
 9. Fluorescent lamp ballasts (Section 2-5314(a)).
 10. Manufactured doors and windows (Section 2-5317).
 11. Oil-fired storage heaters and combination service water heating/space heating boilers (Section 2-5318(a)).
 12. Pool heaters (Section 2-5318(d)).
 13. Occupant sensing devices (Section 2-5319).
 14. Concrete-slab floor perimeter insulation (Section 2-5351(c)).

Enforcement agencies, builders and designers may determine the certification status of any manufactured product of the types specified in this subsection by consulting directories published by the Commission, copies of the letter of certification, accepted by Commission staff, from the manufacturer to the Commission regarding such equipment or products, or a Commission-approved label on such equipment or products.

NOTE NO. 1. See Appendix 2-53A for availability of directories of certified products.

NOTE NO. 2. Chapter 2-53 does not require a builder, designer, or enforcement agency to test any certified product to determine its compliance with minimum specifications and/or efficiencies adopted by the Commission.

NOTE NO. 3. See Sections 2-5313 and 2-5319(e) for certification requirements that apply to installers of additional insulation and of daylighting or lumen maintenance controls.

TABLE 2-53B

Chapter 2-53 Sections	Applicable Building Type	Mandatory	Performance	Prescriptive
2-5301, 2-5302, and 2-5311	All occupancies	2-5301, 2-5302, and 2-5311	--	--
2-5303, 2-5304, and 2-5312- 2-5319	Occupancies A,B,E, H, and R; however, R occupancies are exempt from 2-5316(c) and 2-5319)	2-5303, 2-5304, and 2-5312 to 2-5319	--	--
2-5321-2-5333	First Generation Nonresidential	2-5321	2-5322-2-5325	2-5324-2-5333
2-5341-2-5343	Second Generation Nonresidential	2-5343	2-5341	2-5342
2-5351-2-5352	Second Generation Residential	2-5352	2-5351(a),(b)	2-5351(c)
2-5361-2-5364	First Generation Residential	2-5361	not applicable	2-5362-2-5364
4-1000	All	4-1000		

Definitions

Sec. 2-5302. For the purpose of these standards, certain terms, phrases, words, and their derivatives shall be defined as specified in Section 2-5302. Special terms not found in Section 2-5302 shall be defined as specified in Chapter 2-4 of the California Administrative Code, Title 24, Part 2. Special terms not found in either Chapter 2-53, Section 2-5302 or in Chapter 2-4 of Title 24, Part 2, California Administrative Code shall be defined as specified in Part II, Chapter 4, of the 1985 edition of the Uniform Building Code. Where terms are not defined in any of the aforementioned references, they shall have their ordinary accepted meanings within the context with which they are used. Webster's Third New International Dictionary of the English Language, Unabridged, copyright 1981 shall be considered as providing ordinarily accepted meanings.

ACCESSIBLE is having access thereto, but which first may require the removal or opening of an access panel, door or similar obstruction.

AIR CONDITIONER is one or more factory made assembly(ies) which include an evaporator or cooling coil and an electrically driven compressor and condenser combination, and may include a heating function.

ANSI is the American National Standards Institute.

APPLIANCE EFFICIENCY REGULATIONS are the regulations adopted by the California Energy Commission regulating the minimum efficiency of certain appliances sold in California.

APPROVED CALCULATION METHOD is the California Energy Commission's Public Domain Computer Program, one of the California Energy Commission's Simplified Calculation Methods, or any other calculation method approved by the Executive Director of the California Energy Commission.

AREAL HEAT CAPACITY is the amount of heat, in Btu, that can be stored per square foot of wall assembly by raising the average temperature of the wall assembly one degree Fahrenheit.

ASHRAE is the American Society of Heating, Refrigerating and Air Conditioning Engineers.

ASTM is the American Society for Testing and Materials.

BASIC GLAZING AREA is an area of glazing equal to 16 percent of the gross floor area for residential buildings with less than four habitable stories and 40 percent of the exterior wall area for all other buildings.

BUILDING ENVELOPE is the ensemble of exterior partitions of a building which enclose conditioned spaces and through which thermal energy may be transferred to or from the exterior, unconditioned space(s), or the ground.

CHAPTER 2-53 means the California Administrative Code, Title 24, Part 2, Chapter 2-53.

CLIMATE CONTROL SYSTEM is a system that provides either collectively or individually the processes of comfort heating, ventilating, and/or cooling within or associated with a building.

COEFFICIENT OF PERFORMANCE (COP), Cooling is the ratio of the rate of net heat removal to the rate of total energy input, expressed in consistent units and under designated operating conditions. British thermal units shall be converted to kilowatt hours at the rate of 3413 British thermal units per kilowatt-hour.

CONDITIONED FLOOR AREA is the floor area of enclosed conditioned space on all floors as measured from the interior surfaces of exterior partitions.

EXCEPTION: For buildings of occupancy R these areas shall be measured from the exterior surfaces of exterior partitions.

CONDITIONED PERIMETER is the perimeter (in feet) of exterior wall measured at the level of the floor.

CONDITIONED SPACE is enclosed space that (a) is directly conditioned space or (b) is indirectly conditioned space.

COOLING EQUIPMENT is equipment used to provide mechanical cooling for a room or rooms in a building.

DAYLIT SPACE is the space on or above the floor bounded by the vertical planes or partitions defining the daylit area and the floor or roof above including the interior surfaces of those boundaries.

DEGREE DAY, HEATING is a unit, based upon temperature difference and time, used in estimating fuel consumption and specifying nominal annual heating load of a building. For any one day, when the mean temperature is less than 65°F, there exist as many degree days as there are Fahrenheit degrees difference in temperature between the mean temperature for the day and 65°F. The number of degree days for specific geographical locations shall be those listed in the Energy Conservation Manual. For those localities not listed in the applicable Energy Conservation Manual the number of degree days shall be determined by the applicable enforcing agency.

DESIGN HEAT LOSS is the total calculated heat loss through the building envelope under design conditions.

DIRECTLY CONDITIONED SPACE is an enclosed space that is provided with heating equipment that has a capacity exceeding 10 Btus/(hr·ft²) or is provided with cooling equipment that has a capacity exceeding 10 Btus/(hr·ft²) unless the heating and cooling equipment is designed and thermostatically controlled to maintain a process environment temperature less than 65°F or greater than 85°F for the whole space that the equipment serves.

EAST-FACING is oriented to within 45 degrees of true east, including 45°0'00" south of east (SE) but excluding 45°0'00" north of east (NE).

ECONOMIZER, AIR A ducting arrangement and automatic control system that allows a cooling supply fan system to supply up to 100% outside air to reduce or eliminate the need for mechanical refrigeration during mild or cold weather. With integrated economizers, the economizer controls are integrated with refrigeration controls so that the cooling effect of the water economizer is modulated to provide the desired supply air temperature that would otherwise be provided by the refrigeration system. An integrated system also allows concurrent operation of the economizer and the refrigeration system; when weather conditions are such that the economizer cannot maintain the supply temperature, the economizer shall provide as much of the load as possible, while the refrigeration system operates concurrently to provide the remainder of the load. The economizer shall reduce air flow to the minimum allowed for ventilation when the introduction of more outside air would increase the enthalpy (for enthalpy economizers) or the temperature for temperature economizers of the supply air above that of the return or mixed air.

ECONOMIZER, WATER A system by which the supply air of cooling system is cooled directly and/or indirectly by evaporation of water, or other appropriate fluid, in order to reduce or eliminate the need for mechanical refrigeration. With integrated water economizers, the economizer controls are integrated with refrigeration controls so that the cooling effect of the water economizer is modulated to provide the desired supply air temperature that would otherwise be provided by the refrigeration system. An integrated system also allows concurrent operation of the economizer and the refrigeration system; when weather conditions are such that the economizer cannot maintain the supply temperature, the economizer shall provide as much of the load as possible, while the refrigeration system operates concurrently to provide the remainder of the load. The economizer shall shut-off when its operation would increase the enthalpy (direct evaporation systems) or temperature (indirect evaporation systems) of the supply air above that of the return or mixed air.

EFFICACY is the ratio of light from a lamp to the electrical power consumed, including ballast losses, expressed in lumens per watt.

ENCLOSED SPACE is space that is surrounded by solid surfaces and/or intake and exhaust vents for HVAC systems.

ENERGY BUDGET is a requirement in Chapter 2-53 that a proposed building be designed to consume no more than a specified number of British thermal units (Btu) per year per square foot of conditioned floor area.

ENERGY CONSERVATION MANUAL is the manual(s) developed by the California Energy Commission, under Section 25402.1(c) of the Public Resources Code, to aid designers, builders and contractors in meeting energy efficiency standards.

ENERGY EFFICIENCY MANUAL is the manual developed by the California Energy Commission, under Section 25402.1(c) of the Public Resources Code, to aid designers, builders and contractors in meeting the second generation nonresidential occupancy requirements of the building energy efficiency standards, 1988 edition.

ENERGY EFFICIENCY RATIO (EER) is the ratio of net cooling capacity in Btu/hr to total rate of electric input in watts under designated operating conditions.

ENERGY OBTAINED FROM DEPLETABLE SOURCES is electricity purchased from a public utility or energy obtained from burning coal, oil, natural gas, or liquefied petroleum gases.

ENERGY OBTAINED FROM NONDEPLETABLE SOURCES is energy which is not energy obtained from depletable sources.

ENFORCING AGENCY is the city, county, or state agency responsible for issuing the building permit.

ENVELOPE (see BUILDING ENVELOPE).

EXTERIOR PARTITION is a partition or a surface with conditioned space on one side and unconditioned space, ambient conditions, or the ground on the other side of the surface. The surface of the ground itself is an exterior partition when there is enclosed conditioned space directly above in contact with the ground.

EXTERIOR ROOF/CEILING is a roof or a ceiling with conditioned space on one side and unconditioned space or ambient conditions on the other side.

EXTERIOR WALL is a wall that has conditioned space on one side and unconditioned space, outside air, or the ground on the other side. Party walls separating different tenants are not exterior walls even if the other tenant space is unconditioned.

EXTERIOR WALL AREA is the gross area of the exterior surface of exterior walls, including glazing and doors.

FIRST GENERATION NONRESIDENTIAL OCCUPANCIES include all UBC group A, B, E, and H occupancies except for UBC group B, division 2 offices and retail and wholesale stores other than grocery stores.

FIRST GENERATION RESIDENTIAL OCCUPANCIES include all UBC group R, division 1 occupancies except apartment houses with less than four habitable stories.

FLICKER-FREE OPERATION means that the light does not oscillate on and off in the readily noticeable frequency range of 0.01 to 30 Hertz.

GENERAL LIGHTING is lighting designed to provide a substantially uniform level of illumination throughout an area, exclusive of any provision for special visual tasks or decorative effect.

GLAZING is all transparent or translucent materials in exterior openings.

GLAZING AREA is the area of glazing in exterior openings, including the sash area.

GOVERNMENTAL AGENCY is any public agency or subdivision thereof, including any agency of the state, county, city, district, association of governments, and joint power agency.

HABITABLE STORY is a story which contains space in which humans may work or live in reasonable comfort.

HEAT PUMP is an air conditioner which is capable of heating by refrigeration, and which may or may not include a capability for cooling.

HEATING EQUIPMENT is equipment that is intentionally designed and installed primarily for heating a room or rooms in a building.

HIGH-RISE OFFICE is an office building of four or more habitable stories.

HOTEL is a UBC group R, Division 1 occupancy in a building incorporating six or more guest rooms, 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 as the guest rooms.

HVAC SYSTEM (SPACE CONDITIONING SYSTEM) is a system that provides either collectively or individually the processes of heating, ventilating, and/or cooling within or associated with a building.

INDIRECTLY CONDITIONED SPACE is enclosed space that is not directly conditioned space whose area weighted heat transfer coefficient to directly conditioned spaces exceeds that to the outdoors or to unconditioned spaces; or through which air from directly conditioned spaces is transferred at a rate exceeding 3 air changes per hour.

INFILTRATION is the uncontrolled inward air leakage through cracks and interstices in any building envelope and around windows and doors of a building.

INFILTRATION BARRIER is a waterproof material placed on the outside or the inside of exterior wall framing to restrict inward air leakage while permitting the outward escape of water vapor from the wall cavity.

LOW-RISE OFFICE is an office building of three or fewer habitable stories.

LUMINAIRE is a complete lighting unit consisting of a lamp or lamps together with the parts designed to distribute the light, to position and protect the lamps, and to connect the lamps to the power supply.

MANUAL is capable of being operated by personal intervention.

MANUFACTURED DEVICE is any heating, cooling, ventilation, lighting, water heating, refrigeration, cooking, plumbing fitting, insulation, door, window or any other appliance, device, or system subject to Sections 2-5311, 2-5314, 2-5317, or 2-5318 of Chapter 2-53.

MECHANICAL COOLING is the provision of cooling by transporting air that is lower in temperature than outside air or the mixture of outdoor air and return air, or by the provision of cooled surfaces. The cooling of air by the evaporation of water without the use of chillers or compressors is not considered mechanical cooling.

NEW ENERGY is electrical or chemical energy converted to thermal or mechanical energy expressly for the purpose of comfort heating or cooling.

NONRESIDENTIAL BUILDING is any building which is of an occupancy group A, B, E, and/or H.

OCCUPANCY TYPE is the occupancy category used in Sections 2-5341 to 2-5343 that have separate budgets for compliance with Chapter 2-53. Current occupancy types include:

OFFICES: Offices occupancies providing services other than educational services, and all UBC group B, division 2 occupancies other than retail & wholesale stores, fire stations, workshops, laboratories, factories, storage & warehousing facilities, and restaurants.

GROCERY STORE: A retail or wholesale store whose primary purpose is the sale of foodstuffs requiring additional preparation prior to consumption that has refrigerated cases with a total power input greater than:

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- 1) 5,000 watts for stores with conditioned floor area less than 1000 feet,
or
- 2) 5 watts per square foot for stores with a conditioned floor area greater than 1000 square feet.

RESTAURANT: A food establishment (as defined in Section 27520 of the Health & Safety Code) whose primary purpose is the retail sale of food or drink (1) that has cooking facilities with hoods as required by Section 2003 of the UMC, or (2) provides seating for meals or portions of meals prepared by cooking facilities that are required to have hoods and are in the same building.

RETAIL & WHOLESALE STORES: Occupancies whose primary activity is the sale of merchandise which are not restaurants as defined above.

OUTSIDE AIR is air taken from outdoors and not previously circulated through the system.

PERFORMANCE COMPLIANCE APPROACH is a method of complying with Chapter 2-53 that is described in Section 2-5304.

POWER INDICES are the HVAC power indices or power criteria as defined in subsection 2-5342(e)2. They include the source heating power index, the source cooling power index, and the fan wattage index.

PLENUM is an air compartment connected to one or more air inlets or outlets.

PRESCRIPTIVE COMPLIANCE APPROACH is a method of complying with Chapter 2-53 that is described in Section 2-5304.

PUBLIC FACILITY RESTROOM is a restroom used by the transient public on a regular (rather than casual) basis. Examples include restrooms in service stations, airports, train terminals and convention halls. Restrooms incorporated with private guest rooms in hotels, motels or dormitories, and restroom facilities intended for the use of employees not usually used by the general public, are not considered public facility restrooms.

R_t is the total 'R' value or overall assembly resistance to heat flow including all heat flows through framing members, multiple layers, connections, and air films, and other series and parallel heat flows in $[\text{hr} \times \text{ft}^2 \times \text{°F}] \div \text{Btu}$.

READILY ACCESSIBLE is capable of being reached quickly for operation, renewal, or inspection, without requiring those to whom ready access is requisite to climb over or remove obstacles or to resort to the use of portable access equipment.

RECOOL is the sensible cooling of air that has been previously heated by HVAC systems serving the same building.

RECOVERED ENERGY is energy utilized which would otherwise be wasted from an energy system.

REHEAT is the heating of air that has been previously cooled wither by mechanical refrigeration or economizer coding systems.

RESIDENTIAL BUILDING is a building which is of an occupancy group R.

SECOND GENERATION NONRESIDENTIAL OCCUPANCIES are a subgroup of UBC group B, division 2 occupancies which include office buildings and all retail and wholesale stores except grocery stores.

SECOND GENERATION RESIDENTIAL OCCUPANCIES include all UBC group R, division 3 occupancies and apartment houses of less than four habitable stories.

SERVICE SYSTEMS is the HVAC, service water heating, electrical distribution, and illuminating systems provided in a building.

SERVICE WATER HEATING is heating of water for domestic purposes other than comfort heating.

SETS OF POWER INDICES are specific related combinations of the fan wattage index, the source heating power index, and the source cooling power index used in the alternative Component Packages in Section 2-5342 for prescriptive compliance with Chapter 2-53 for the types of buildings regulated by Sections 2-5341 to 2-5343.

SHADING is the protection from heat gains due to direct solar radiation by permanently attached exterior devices, glazing materials, adherent materials applied to the glazing, or an adjacent building.

EXCEPTION: In second generation residential occupancies, shading is protection from direct solar radiation by uses of devices affixed to the structure.

SHADING COEFFICIENT is the ratio of the solar heat gain through a glazing system corrected for external and internal shading to the solar gain through an unshaded single light of double strength sheet glass under the same set of conditions.

SKYLIGHT is any opening in the roof surface which is glazed with a transparent or translucent material.

SOUTH-FACING is oriented to within 45 degrees of true south.

SPECIAL GLAZING is glazing which has a maximum U value of 0.65 for all glazed surfaces.

SUSPENDED EXTERIOR FLOOR is a floor that has conditioned space on one side and unconditioned space or ambient air on the other side.

SYSTEM is a combination of equipment and/or controls, accessories, interconnecting means, and terminal elements, by which energy is transformed to perform a specific function, such as climate control, service water heating or illumination.

TASK-ORIENTED LIGHTING is lighting designed specifically to illuminate one or more task locations, and generally confined to those locations.

THERMAL RESISTANCE (R) is the measure of the resistance of a material or building component to the passage of heat in $(\text{hr}\cdot\text{ft}^2\cdot^\circ\text{F})/\text{Btu}$.

TINTED GLAZING is glazing material which is permanently tinted or permanently surface coated by the manufacturer and provides a maximum shading coefficient as specified in Chapter 2-53.

TOTAL R-VALUE is R_t as that term is defined.

UBC is the 1988 edition of the Uniform Building Code.

UMC is the 1988 edition of the Uniform Mechanical Code.

UNCONDITIONED SPACE is space within a building which is not conditioned space.

U-VALUE (Overall Coefficient of Thermal Transmittance) is the heat flow rate through a given construction assembly, air-to-air, expressed in $\text{Btu} \cdot [\text{hr} \times \text{ft}^2 \times ^\circ\text{F}]$.

VAPOR BARRIER is a material with a permeance of one perm or less which provides resistance to the transmission of water vapor.

VENTILATION AIR is that portion of supply air which comes from outside plus any recirculated air that has been treated to maintain the desired quality of air.

WEST-FACING is oriented to within 45 degrees of true west including $45^\circ 0' 00''$ due north west (NW) but excluding $45^\circ 0' 0''$ south of west (SW).

ZONE is a space or group of spaces within a building with sufficiently similar comfort conditioning requirements so that comfort conditions can be maintained throughout by a single controlling device.

Design Conditions and Calculations of Energy Consumption

Sec. 2-5303.

- (a) For the purposes of calculating HVAC sizing for buildings of occupancy R, the determination of annual energy consumption for compliance with the energy budgets in Sections 2-5322 and 2-5341, and overall thermal transfer value (OTTV), where required by Chapter 2-53, indoor design temperatures shall be 70°F for heating and 78°F for cooling. For other load calculations that may be done in conjunction with compliance with these standards, indoor design conditions shall be in accordance with ANSI/ASHRAE 55-1981, except that humidification and dehumidification need not be considered. Heating and cooling design loads shall be determined in accordance with the procedures described in the ASHRAE Handbook, 1985 Fundamentals Volume, the

2-5303(a) - 2-5304(c)

ASHRAE Cooling and Heating Load Calculation Manual (1978), or comparable computation procedure. Outdoor design air temperatures shall be those listed in the 0.2 percent Winter Dry Bulb column for heating and the 0.5 percent Summer Dry Bulb and the 0.5 Wet Bulb columns for cooling, based on percent-of-year in ASHRAE publication SPCDX: Climatic Data for Region X, Arizona, California, Hawaii, and Nevada, 1982.

- (b) For purposes of calculating energy consumption of a building where required by this chapter, the total calculated annual consumption of electricity, natural gas, fuel oil, and propane shall be converted to Btu at the rates shown in Table 2-53C.

TABLE 2-53C.
ENERGY CONVERSION RATES

Energy Sources	Btu per unit consumption
Electricity	10,239 Btu/kilowatt-hour
Natural Gas	100,000 Btu/therm
Fuel Oil	138,400 Btu/gallon
Propane	91,080 Btu/gallon

Compliance Approaches

Sec. 2-5304.

- (a) General. Chapter 2-53 establishes two compliance approaches for new buildings. Under the performance compliance approach, a building must comply with specified mandatory features, and must be designed to consume no more energy than specified in the applicable energy budget. Under the prescriptive compliance approach, a building must comply with the same specified mandatory features, and must also comply with prescriptive requirements that the Commission has determined will result in design meeting the energy budget.
- (b) Applicable Sections. Table 2-53B lists the sections with which new buildings must comply.
- (c) Determination of Number of Stories; Applicability of Standards. The energy budgets for offices in Section 2-5341 differ for buildings of three or fewer, and four or more, habitable stories. The provisions of Sections 2-5351 and 2-5352 apply only to second generation residential occupancies in buildings.

Only those habitable stories that have more than 50 percent of their volume above grade as defined in the 1985 Uniform Building Code shall be counted in determining how many habitable stories a building has.

Installation of Appliances and Equipment

Sec. 2-5314.

- (a) Certified Appliances. If any appliance of the types listed in Table 2-53G is installed, it shall have been certified to the California Energy Commission by its manufacturer to comply with the efficiency standards for such appliances. See Appendix 2-53A for availability of directories of certified appliances.

TABLE 2-53G. APPLIANCES SUBJECT TO CERTIFICATION

1. Refrigerators, refrigerator-freezers, and freezers which can be operated by alternating current electricity.

EXCEPTIONS:

- I. Refrigerators and refrigerator-freezers with total refrigerated volume exceeding 39 cubic feet.
- II. Freezers with total refrigerated volume exceeding 30 cubic feet.
- III. Refrigerators and freezers designed to be used without doors.
- IV. Remote refrigerators and freezers.

2. Room air conditioners

3. Central air conditioning heat pumps (regardless of capacity, except that requirements for central air conditioning heat pumps with cooling capacity of 135,000 Btu per hour or more apply to heating performance but not cooling performance) and other central air conditioners with a cooling capacity less than 135,000 Btu per hour.

4. Gas space heaters of the following types:

- a. Fan type central furnaces with input rate less than 400,000 Btu per hour.
- b. Boilers.
- c. Wall furnaces.
- d. Floor furnaces.
- e. Room heaters.
- f. Unit heaters.
- g. Duct furnaces.

NOTE: See Section 2-5314(b) for requirements applicable to gravity type central furnaces and to fan type central furnaces with input rates of at least 400,000 Btu per hour.

5. Water Heaters.

EXCEPTION: Nonstorage-type electric water heaters.

6. Plumbing fittings, including showerheads, lavatory faucets, and sink faucets.

7. Fluorescent lamp ballasts (and luminaires with fluorescent lamp ballasts) which are intended to operate at nominal input voltage of 120 or 277 volts, have an input frequency of 60Hz, have maximum lamp operating currents greater than 350 milliamperes but less than 500 milliamperes, and can be used to operate fluorescent lamp types F40T12 or F96T12.

EXCEPTION NO. 1: Those designed to be used in ambient temperatures of 0°F or less.

EXCEPTION NO. 2: Those with power factors less than 0.60.

EXCEPTION NO. 3: Those designed for dimming.

(b) Minimum Efficiency of Equipment.

1. Cooling Equipment. If any equipment of the types specified in Table 2-53H is installed, it shall meet or exceed the minimum efficiency requirements in Table 2-53H. Such minimum efficiency shall be certified by the manufacturer of the equipment and shall have been determined by testing using the procedure specified in Table 2-53I for that type of equipment.

For equipment classified as B or C in Table 2-53H, the COP specified is for the water-chilling package or hydronic heat pump as furnished by the manufacturer. For water-chilling packages the COP does not include energy to drive chilled-water and condenser-water pumps or cooling tower fans. For hydronic heat pumps the COP does not include the energy to drive circulating water pumps or cooling tower fans, but does include the conditioned supply-air fan-motor energy when included as a part of the model number of the hydronic heat pump. For equipment classified as D in Table 2-53H, COP shall be calculated as the net cooling output divided by the total heat input, but excluding electrical auxiliary inputs.

TABLE 2-53H.
MINIMUM EFFICIENCY OF COOLING EQUIPMENT,

Classification	Type	Condensing Means	EER	COP
A	Electrically Driven Air Conditioners (135,000 Btu per hour and over)	Air	8.2	-
		Evaporative or Water	9.2	-
B				
Electrically Driven Water Chilling Packages				
Centrifugal or Rotary Type, with Condenser		Air	-	2.34
		Water	-	4.04
Reciprocating Type, with Condenser		Air	-	2.46
		Water	-	3.51
Reciprocating Type, without Condenser		Air	-	2.90
		Water	-	3.51

Hydronic Heat Pumps, Reciprocating type (135,000 Btu per hour and over)		Water	-	2.75
C				
Electrically Driven Condensing Units (65,000 Btu per hour and over)		Air	-	2.78
		Evaporative or Water	-	3.66
D				
Heat Operated				
Direct Fired (gas, oil)			-	0.48
Indirect Fired (Steam, hot water)			-	0.68
E				
Computer Room Air Conditioner (135,000 Btus per hour and over)		Air	7.7	-
		Water	8.4	-

TABLE 2-53I.
TEST PROCEDURES FOR COOLING EQUIPMENT

Classification	Type	Test Procedure
A	Unitary Air-Conditioning Equipment Commercial and Industrial Unitary Air Conditioning Equipment	ARI 210-81 ARI 360-86
	Air-Source Unitary Heat Pump Equipment	ARI 240-81
	Water-Source Heat Pumps Commercial and Industrial	ARI 320-86
	Heat Pump Equipment	ARI 340-86
B	Centrifugal or Rotary Water-Chilling Packages	ARI 550-86
	Reciprocating Water-Chilling Packages	ANSI/ARI 590-86
	Water-Source Heat Pump	ARI 320-86
	Groundwater-Source Heat Pump	ARI 325-86
C	Positive Displacement Refrigerant Condensing Units	ARI 520-86
D	Absorption Water-Chilling Packages Gas Fired Absorption Summer Air-Conditioning Appliances	ARI 560-82 ANSI Z21.40.1-1981
E	Computer and Data Processing Room Air-Conditioners	ASHRAE 127P

2. Gas-fired heating equipment. If a fan type central furnace with input rate of at least 400,000 Btu per hour or a gravity type central furnace is installed, it shall have a minimum thermal efficiency of 75 percent, as certified by the manufacturer of the equipment, based on the test procedure ANSI Z21.47-1978.
3. Oil-fired heating equipment. If oil-fired heating equipment is installed, it shall have a minimum combustion efficiency of 75 percent at maximum rated output, as certified by the manufacturer of the equipment. Combustion efficiency is defined as 100 percent minus stack losses in percent of heat input. Stack losses are:
 - A. Loss due to sensible heat in dry flue gas.
 - B. Loss due to incomplete combustion.

C. Loss due to sensible and latent heat in moisture formed by combustion of hydrogen in the fuel.

(c) Ignition of Gas Appliances. If any gas appliance of the following types is installed, it shall not be equipped with a continuously burning pilot:

- 1. Fan type central furnaces.
- 2. Fan type wall furnaces.
- 3. Household cooking appliances.
- 4. Pool heaters.

EXCEPTION: The following gas appliances shall be permitted with a constant burning pilot.

- 1. Those designed to burn only liquefied petroleum gases.
- 2. Any household cooking appliance which meets all of the following conditions:
 - A. It does not have an electrical supply voltage connection.
 - B. It has no more than one constant burning pilot light.
 - C. The pilot consumes less than 150 Btu per hour.

NOTE: An intermittent ignition device is not required for household water heaters not used to heat pools.

(d) Heat Pumps--Space Heating Mode.

Heat pumps shall be installed with controls to prevent electric resistance supplementary heater operation when the heating load can be met by the heat pumps alone. Electric resistance supplementary heater operation is permitted during transient periods, such as start-ups and following room thermostat setpoint advance, when controls are provided which use preferential rate control, intelligent recovery, staging, ramping, or similar control mechanisms designed to preclude the unnecessary operation of supplementary heating during the recovery period. Supplementary heater operation is also permitted during defrost.

The cut-on temperature for the compression heating shall be higher than the cut-on temperature for the supplementary heat, and the cut-off temperature for the compression heating shall be higher than the cut-off temperature for the supplementary heat.

Heat pumps with supplementary heat derived from sources other than electric resistance need not comply with the requirements of this subsection.

(e) Lavatories in Restrooms of Public Facilities.

1. Shall be equipped with:

- A. Outlet devices that limit the flow of hot water to a maximum of 0.5 gallons per minute, or with
- B. Self-closing faucets that limit delivery to a maximum of 0.25 gallons of hot water for recirculating systems and to a maximum of 0.5 gallons for nonrecirculating systems, and;

2. Shall be equipped with devices that limit the outlet temperature to 110°F.

HVAC Controls

Sec. 2-5315.

- (a) Each HVAC system shall be equipped with at least one automatic device to setback or shut-off the system during periods of non-use or alternate use of the building spaces or zones served by the system.
- (b) Each zone or residential dwelling unit shall be provided with at least one automatic temperature control device for the regulation of space temperature. Each floor of a nonresidential building with conditioned space shall contain at least one zone. Zone temperature controls shall:
 - 1. Be able to maintain space temperature set points from 55°F to 85°F. Two or more replaceable fixed set-point devices, one for cooling and one for heating, may be used in lieu of continuously adjustable set point devices.
 - 2. Be able to operate zone heating and cooling in sequence if both are provided.
 - 3. Provide a temperatures range adjustable up to 10°F between full heating and full cooling capacity to the zone, if the zone has both heating and cooling capability. If the HVAC system uses reheat or recool for conditioning this zone, this control shall reduce cooling capacity to the zone before reheating and reduce heating capacity to the zone before recooling.

- EXCEPTION NO.1: Hotels are not required to comply with subsection 2-5315(a).
- EXCEPTION NO.2: Museums, rare book libraries, historical archives, and buildings or HVAC zones housing special processes or special materials or providing continuous indoor habitation for plants or captive animals that require constant temperatures and continuous operation to prevent degradation of materials, the process, or the living environment need not comply with Section 2-5315(a) or (b) as applicable.
- EXCEPTION NO.3: Small ancillary HVAC systems whose input power is less than 500 watts may have readily accessible manual on/off switching in lieu of the requirements of subsection 2-5315(a).

Ventilation Systems

Sec. 2-5316.

- (a) Air handling duct systems shall be constructed, installed, sealed, and insulated as provided in Chapter 10 of the State Mechanical Code (Title 24, Part 4).
- (b) On mechanical ventilation supply and exhaust systems capable of moving more than 5,000 cfm of air, automatic dampers interlocked and closed on fan shutdown shall be provided. On gravity ventilating systems, either automatic or readily accessible manually operated dampers in all openings to the outside, other than combustion air openings, shall be provided.

EXCEPTION: In buildings of occupancy R, all fan systems, regardless of volumetric capacity, exhausting air from the building to the outside shall be provided with backdraft or automatic dampers to prevent air leakage.

- (c) Ventilation systems serving first generation nonresidential occupancies shall
 - 1. be capable of supplying at least the "minimum" quantity of outdoor air listed for the area in Section 6 of ASHRAE Standard 62-73, or 5 cfm per person, whichever is higher for any area in which smoking is prohibited.
 - 2. be capable of supplying at least the "recommended" quantity of outdoor air listed for the area in Section 6 of ASHRAE Standard 62-73, or 5 cfm per person, whichever is higher for any area in which smoking is permitted.
 - 3. be allowed to reduce outside air requirements to 33 percent of those required in Section 6 of ASHRAE 62-73, so long as a minimum 5 cfm per person of outside air is delivered to each space or zone at all times such spaces or zones are occupied, if the HVAC system is designed to utilize outside air for cooling in accordance with Section 2-5330.
- (d) Ventilation systems serving second generation nonresidential occupancies shall comply with the requirements of Section 2-5343.

NOTE: Meeting the acceptable ventilation air quality criteria established in ASHRAE 62-1973 is recommended.

- (e) If daylighting or lumen maintenance controls are installed to comply with Sections 2-5341(b) or 2-5342(d), they shall have minimum specifications and be installed in accordance with the following.
1. Daylighting controls shall be capable of reducing the general lighting of the controlled area by at least one-half while maintaining a uniform level of illuminance throughout the area.
 2. If the control is a dimmer, the control shall have the capability, as certified by the manufacturer, of providing electrical outputs to the lamp for flicker-free operation throughout the dimming range and without causing premature lamp failure.
 3. The controls shall incorporate time delay circuits to prevent cycling of light level changes of less than five minutes.
 4. If the control uses step switching with separate "on" and "off" fittings for the steps, adjustment shall allow sufficient separation of "on" and "off" points to prevent cycling.
 5. Each photocell sensor shall be a light diffusing type and shall not have a mechanical slide cover or other device that would permit easy unauthorized disabling of the control.
 6. The manufacturer shall provide step-by-step instructions for installation and start-up calibration to design footcandle levels.
 7. Daylighting controls shall also incorporate either:
 - (A) Programmable timing controls capable of separate schedules for weekdays and weekends as well as temporary override and automatic return. The temporary override need not be wired in series with other switching; OR
 - (B) Occupancy sensing devices to automatically turn off all daylight controlled non-emergency lighting in the absence of occupants. These devices shall meet specifications stated in Section 2-5319, Exception No. 2.
 8. The installer of controls shall do all of the following:
 - (A) Locate the photocell sensor in accordance with the designer's or manufacturer's instructions.
 - (B) Provide to the building owner or occupant certification that the initial calibration of the controls was done according to the designer's or manufacturer's instructions.
 - (C) Install the daylighting controls so as to control only luminaires within the daylight area(s).

2-5319(f) - 2-5319 EXCEPTIONS

- (f) If occupant-sensing devices are installed to comply with Sections 2-5341(b) or 2-5342(d), they shall have the specifications of Sections 2-5319(e)2 and 2-5319(e)3.
- (g) If daylighting controls, lumen maintenance controls, or occupant-sensing devices are installed to comply with Sections 2-5341(b) or 2-5342(d), they shall visibly or audibly warn the occupants or building operators when they have failed or malfunctioned.
- (h) For retail and wholesale stores complying with Sections 2-5341 through 2-5343, valance lighting shall be separately switched and feature displays shall be separately switched on circuits of 20 amps or less. If the total lighting power for feature displays in a store exceeds four such circuits, switching shall be controlled by an automatic programmable timer that must be capable of:
 - 1. Programming different schedules for weekdays and weekends; and
 - 2. Temporary override by occupants with automatic return to original schedules (override controls shall be readily accessible).
- (i) One-lamp or three-lamp fluorescent lighting luminaires, of the type listed as subject to certification in Table 2-53G, recess mounted within 10 feet of each other or pendant or surface mounted within one (1) foot of each other shall be tandem wired to eliminate unnecessary use of single lamp ballasts. Tandem wiring consists of pairs of luminaires operating with one lamp in a luminaire powered from a single two-lamp ballast contained in a second luminaire.

EXCEPTION NO. 1: Hotels and other group R occupancies are not required to comply with Section 2-5319.

EXCEPTION NO. 2: Any area whose actual installed connected lighting load is less than 1.0 watt per square foot throughout the entire area, or in which a single light source (lamp) produces all of the illumination in the area, need not comply with Section 2-5319(c).

EXCEPTION NO. 3: Any area in which the lights are controlled by an occupant-sensing device that automatically turns the lights off soon after the area is vacated, need not comply with Section 2-5319(b) or (c), provided that the manufacturer of the device has certified to the Executive Director of the California Energy Commission that the device meets the criteria of either A, B, or C below:

- A. The device does not emit any radiated energy (including but not limited to electromagnetic, ultraviolet, microwave, or infrared radiation) as a signal for sensing occupants within an area.
- B. If the device emits ultrasonic radiation as a signal for sensing occupants within an area, the device:
 - (1) Is one for which an Initial Report has been submitted to the Bureau of Radiological Health, Federal Food and Drug Administration, under 21

ENERGY CONSERVATION STANDARDS FOR NEW FIRST GENERATION NONRESIDENTIAL
OCCUPANCIES

Design Requirements

Sec. 2-5321. First generation nonresidential occupancies in buildings comply with Chapter 2-53 if they are designed and constructed to comply with requirements of the applicable subsection (a), (b), (c), (d) or (e):

NOTE: See Sections 2-5341 to 2-5343 for standards applicable to offices, retail and wholesale stores (except groceries).

- (a) The building or occupancy's service systems consume no more energy than is permitted by Section 2-5322 as determined by the analysis described in Section 2-5323, and comply with Sections 2-5311 through 2-5319.
- (b) Nondepletable energy sources provide either of the following: Over 40 percent of the annual thermal energy requirement (heating, cooling, service water heating) or over 20 percent of the annual total energy requirement for all service systems. Documentation, as described in the Energy Conservation Design Manual, shall be provided to verify the percentage of annual energy use derived from such nondepletable sources.
- (c) The building envelope and the service systems comply with Sections 2-5324 through 2-5333 and Sections 2-5311 through 2-5319.
- (d) The building or occupancy's service systems consume no more energy than is permitted by Table 2-53R for low rise offices when calculated as though it were an office occupancy subject to Sections 2-5341 to 2-5343, after adjustment for lighting allowed for the actual occupancy. The budgets in Table 2-53R must be adjusted for lighting for the specific occupancy by the use of the "tailored lighting approach" in Section 2-5342(d)2 [in accordance with Section 2-5341(b)2 where the maximum adjusted lighting power density (MALPD) is taken as 1.5 watts per square foot].
- (e) Regardless of its nonresidential occupancy group or type or whether or not the occupancy is known, the occupancy or building meets the requirements for low rise office Alternative Component Package A, B, or C of Section 2-5342 and additional Sections as specified below:
 1. The envelope shall comply with the building envelope requirements as specified in Section 2-5342.
 2. The lighting system shall comply with the lighting requirements of Section 2-5342(d)2. for the known design lighting tasks or shall have an adjusted lighting power density of no more than 0.8 watts per square foot.
 3. The HVAC system must meet the requirements of Sections 2-5329, 2-5332, and 2-5342(e).

Energy Budgets

Sec. 2-5322.

- | (a) A building of a first generation nonresidential occupancy complies with Chapter 2-53 if it is designed and constructed to comply with Sections 2-5311 through 2-5319 and if the total calculated annual energy consumption of its service systems (excluding energy from nondepletable sources) does not exceed the product of the square feet of conditioned floor area and the allowable energy budget (in Btu per year per square foot) set forth in Table 2-53K.

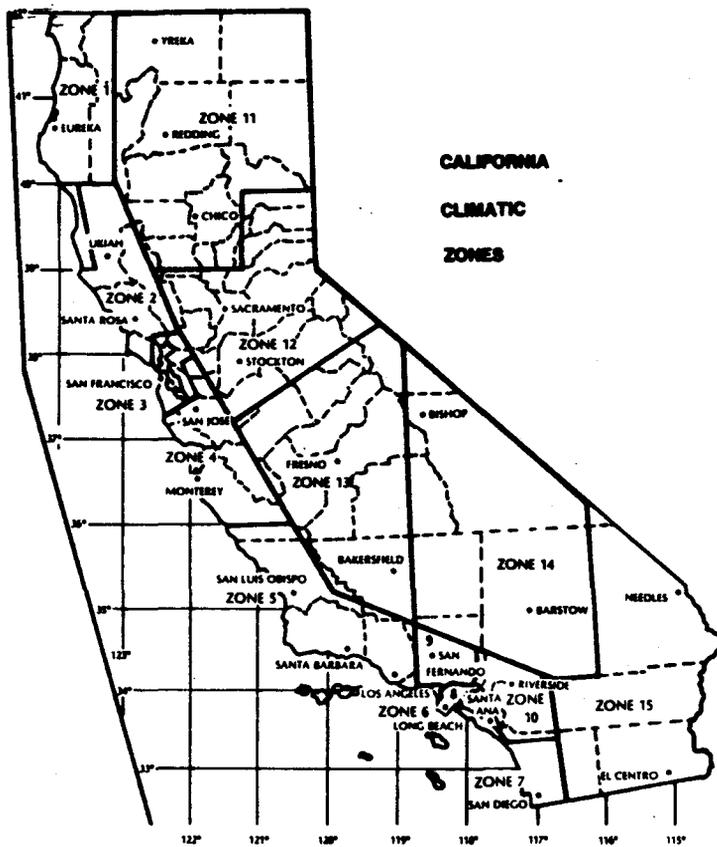


FIGURE 2-53A
CLIMATE ZONES FOR
FIRST GENERATION NONRESIDENTIAL OCCUPANCIES

Building Envelope

Section 2-5324.

(a) General. A building that will be both heated and cooled shall meet the more stringent of the heating and cooling design requirements for the building envelope provided in Sections 2-5325 and 2-5326. A building that is to be heated only shall meet requirements of Section 2-5325. A building that is to be cooled only shall meet the requirements of Section 2-5326.

(b) The U-value of any component such as roof/ceiling, wall, or floor may be increased and the U-value for other components decreased until the overall heat gain or heat loss for the entire building envelope does not exceed the total resulting from conformance to the stated U-values. The overall heat loss is measured by the overall U-value ($U_{overall}$) and the overall heat gain is measured by the overall thermal transfer value ($OTTV_0$),

1. where the overall U-value, $U_{overall}$:

$$U_{overall} = [U_{or}A_{or} + U_{ow}A_{ow} + U_{of}A_{of}] / [A_{or} + A_{ow} + A_{of}]$$

where A_{of} is the overall floor area above unheated spaces excluding floors on grade and where the other terms to the right of the equals are defined in Section 2-5325, and

2. where the overall thermal transfer value, $OTTV_0$:

$$OTTV_0 = [(OTTV_r \times A_{or}) + (OTTV_w \times A_{ow})] / [A_{or} + A_{ow}]$$

as the terms to the right of the equals sign are defined in Section 2-5326.

Heating Design Criteria

Sec. 2-5325.

(a) Walls. The combined thermal transmittance value (U_{ow} value) for the gross area of exterior walls consisting of opaque wall areas, window areas, and door areas, that enclose interior heated space, and including areas of foundation walls that enclose heated space, shall not exceed the values shown in Figure 2-53B for the degree days applicable.

Equation 2-53E shall be used to determine acceptable combinations of wall, window, and door areas, and thermal properties to meet the requirements of Figure 2-53B.

**ENERGY CONSERVATION STANDARDS FOR NEW SECOND GENERATION
NONRESIDENTIAL OCCUPANCIES.**

Requirements

Sec. 2-5341

(a) Second generation nonresidential occupancies in new buildings and first generation nonresidential occupancies complying as offices in accordance with Section 2-5321(d) or (e) shall comply with Sections 2-5301 through 2-5304, 2-5311 through 2-5319, 2-5343, and either 2-5341(b) or 2-5342.

(b) Energy Budgets--Performance Compliance Approach.

1. Any second generation nonresidential occupancy in a new building and first generation nonresidential occupancies complying as offices in accordance with Section 2-5321(d) using a performance compliance approach shall be designed to use no more British thermal units (Btus) of energy per square foot of conditioned floor area per year from depletable sources than that specified in Table 2-53R, Table 2-53S, or Table 2-53Sa for the applicable building type, and the applicable climate zone shown in Figure 2-53G (See Section 2-5351(b)). Any such building shall also comply with Sections 2-5301 through 2-5304, 2-5311 through 2-5319 and 2-5343. Energy required for building cooling shall be included in the energy consumption calculated for the building even if the plans and specifications do not indicate that air conditioning will be installed.

2. The budgets in Tables 2-53R, 2-53S, 2-53Sa may be adjusted when the optional calculation for maximum connected lighting load in Section 2-5342(d)2 indicates more than the watts per square foot for the Maximum Adjusted Lighting Power Density for alternative component Package A. The adjusted budget may be calculated by the following formula:

$$AEB = EB + [(MACLL - MALPD \text{ watts/ft}^2) * 38.0 \text{ kBtu/watt-year}]$$

AEB = Adjusted Energy Budget

EB = Energy Budget from Table 2-53R, Table 2-53S, or Table 2-53Sa.

MACLL = Maximum adjusted connected lighting load from 2-5342(d)2 in watts/ft².

MALPD = Maximum Adjusted Lighting Power Density from Alternative Component Package A for nonresidential buildings (Tables 2-53V1 through 2-53WA16) for the appropriate occupancy and climate zone.

3. For purposes of demonstrating Performance Approach Compliance, the design lighting power density of the building may be adjusted in accordance with Equation 2-53S in Section 2-5342(d)1.B.

TABLE 2-53R
ENERGY BUDGETS FOR OFFICES IN BUILDINGS OF THREE OR FEWER HABITABLE STORIES
[kBtu per square foot of conditioned floor area per year]

Climate Zone	Conditioned Area-to-Conditioned Perimeter Ratio ^{1,2}							
	13.74 or less	13.75 to 15.99	16.00 to 19.99	20.00 to 22.49	22.50 to 24.99	25.00 to 27.49	27.50 to 29.99	30.00 or more
1	139	131	124	113	106	101	97	92
2	184	172	162	146	135	127	121	114
3	133	125	119	109	103	98	94	90
4	143	135	128	117	109	103	100	95

5	141	133	126	115	107	102	98	93
6	198	183	170	151	137	127	119	110
7	146	138	131	120	112	107	103	98
8	158	148	140	127	118	112	108	102

9	170	160	151	137	126	119	113	107
10	189	177	166	149	138	130	124	117
11	222	207	194	174	159	148	140	130
12	205	189	176	156	143	133	127	119

13	210	196	184	166	152	142	135	126
14	233	217	203	182	166	155	146	136
15	261	244	229	205	188	175	166	154
16	194	181	170	153	140	131	125	117

¹ The conditioned area-to-conditioned perimeter ratio may be applied for each story of a building or each tenant space in any single story of a building.

² The budgets for a multi-story building may be met on a total building basis under Section 2-5304(d)2.

TABLE 2-53S
 ENERGY BUDGETS FOR OFFICES OF FOUR OR MORE HABITABLE STORIES
 [kBtu per square foot of conditioned floor area per year]

Climate Zone										
Conditioned Area-to-Conditioned Perimeter Ratio ^{1,2}										
15.99 or less	16.00 to 22.49	22.50 to 24.99	25.00 to 27.49	27.50 to 29.99	30.00 to 31.99	32.00 to 34.99	35.00 to 39.99	40.00 to 44.99	45.00 or more	
1	109	107	105	103	101	99	98	96	94	92
2	128	125	122	119	116	114	112	109	107	104
3	104	102	101	99	98	96	95	93	91	89
4	110	108	106	104	102	100	99	96	95	92

5	111	109	107	105	103	101	100	97	96	93
6	126	124	122	119	117	115	113	111	109	105
7	104	103	101	99	98	97	96	94	93	91
8	111	109	107	105	103	102	100	98	97	95

9	115	112	110	108	106	105	103	101	99	97
10	125	122	120	117	114	112	111	108	106	104
11	146	142	138	134	130	128	125	122	119	117
12	139	137	136	134	133	131	130	127	124	120

13	140	136	132	129	126	123	121	118	115	112
14	149	145	141	137	134	131	128	124	121	117
15	156	152	148	143	140	137	134	130	127	123
16	137	133	130	126	123	120	118	114	111	108

- ¹ The conditioned area-to-conditioned perimeter ratio may be applied for each story of a building or each tenant space in any single story of a building.
- ² The budgets for a multi-story building may be met on a total building basis under Section 2-5304(d)2.

TABLE 2-53Sa
ENERGY BUDGETS FOR RETAIL AND WHOLESALE STORES
[kBtu per square foot of conditioned floor area per year]

Climate Zone	Conditioned Area-to-Conditioned Perimeter Ratio 1,2							
	13.74 or less	13.75 to 15.99	16.00 to 19.99	20.00 to 22.49	22.50 to 24.99	25.00 to 27.49	27.50 to 29.99	30.00 or more
1	171	162	155	145	138	133	130	127
2	257	238	222	199	185	176	170	164
3	174	164	156	144	137	132	129	125
4	194	181	171	157	147	142	138	134
5	185	174	164	151	142	137	133	129
6	296	267	244	212	191	179	171	163
7	186	174	165	151	143	137	134	130
8	209	195	183	167	156	150	146	142
9	229	212	199	180	168	160	155	150
10	268	246	229	205	189	180	174	168
11	317	289	266	235	215	203	195	188
12	295	270	249	220	201	189	181	173
13	302	275	255	225	207	196	189	182
14	330	300	276	243	222	210	202	193
15	369	336	309	271	248	233	224	214
16	249	230	215	194	180	172	167	161

- 1 The conditioned area-to-conditioned perimeter ratio may be applied for each story of a building or each tenant space in any single story of a building.
- 2 The budgets for a multi-story building may be met on a total building basis under Section 2-5304(d)2.

4. The lighting power of certain applications of lighting may be excluded as follows:
- Theatrical lighting designed specifically to light stages, dance floors, and other similar areas which incorporate special controls and special effects lighting equipment.
 - Application of lighting equipment whose visible radiation is used for nonvisual purposes. Examples are, but not limited to, agricultural lighting used for purposes of stimulating production or reproduction, drying or curing of paints or resins, and infrared heat lamps for food warming.
 - Studio lighting for photographic processes.

For purposes of demonstrating Performance Approach Compliance when an exemption is taken within an area, the lighting load for that area shall be the larger of: (a) the actual design wattage of any additional nonexempt lighting for visual tasks or (b) wattage allotment determined in accordance with provisions of Section 2-5342(d).

5. Energy for Energy Storage. The total calculated annual energy consumption for these energy budgets need not include any energy used by equipment to transfer energy into or out of an energy storage medium designed to shift energy use away from the utilities' peak demand period. This excludable energy includes the added energy consumption due to additional pressure drops from longer pipe or duct runs or heat exchangers and the energy required to maintain the energy storage medium in the desired temperature range or the stored energy state. To exclude such energy, the building permit applicant shall demonstrate to the satisfaction of the enforcement agency that the proposed building will contain such equipment, by indicating said equipment on the plans and specifications submitted with the building permit application.

Alternative Component Packages: Prescriptive Compliance Approach

Sec. 2-5342. Any second generation nonresidential occupancy in a new building and first generation nonresidential occupancies complying as offices in accordance with Section 2-5321(e) using a prescriptive compliance approach shall have installed the measures in an Alternative Component Package listed in Tables 2-53V1 through 2-53WA16 and described further in Sections 2-5342(a)-2-5342(e), for the applicable occupancy, and for the applicable climate zone in Figure 2-53G (See Section 2-5351(b)). Any such building shall also comply with Sections 2-5301 through 2-5304, 2-5311 through 2-5319, and 2-5343.

(a) Opaque Building Envelope.

1. The exterior roof and suspended exterior floor shall have a total R-value (R_t) of at least the value shown in the Alternative Component Package. Where parts of the roof or floor have an R-value different

from other parts, the total R-value shall be determined using the weighted average technique shown in Equation 2-53R.

2. The opaque exterior wall shall have a total R-value (R_t) of at least the value shown for the areal heat capacity of the opaque wall. Where parts of the opaque exterior wall have a heat capacity or R-value different from other parts, the total R-value shall be determined using the weighted averaging techniques shown in Equations 2-53Q and 2-53R. The wall complies if R_a is at least R_m .

A. Different Heat Capacities.

EQUATION 2-53Q

$$R_m = \frac{A_T}{\frac{A_{HC1}}{R_{HC1}} + \frac{A_{HC2}}{R_{HC2}} + \dots + \frac{A_{HC5}}{R_{HC5}}}$$

Where

R_m = Minimum total R-value required for the opaque wall as a whole.

$A_{HC1(2, \dots, 5)}$ = Total area of all parts of the opaque wall with an areal heat capacity shown in the first (second, ..., fifth) category in the Alternative Component Package.

$R_{HC1(2, \dots, 5)}$ = Minimum total R-value required in the Package for the first (second, ..., fifth) areal heat capacity category.

A_T = Total opaque wall area.

B. Different R-values.

EQUATION 2-53R

$$R_a = \frac{A_T}{\left| \frac{A_1}{R_1} + \frac{A_2}{R_2} + \dots + \frac{A_n}{R_n} \right|}$$

Where R_a = weighted average total R-value of opaque wall proposed to be installed.

$A_1(2, \dots, n)$ = Total area of all parts of the opaque wall with a total R-value of $R_1(2, \dots, n)$

3. If Alternative Component Packages C or F are installed, wall insulation shall be integral with or exterior to the rest of the wall assembly.

(b) Glazing in Exterior Walls.

1. The glazing area in exterior walls for the entire building shall be no more than the percentage of the exterior surface area of walls (excluding parapets, wing walls, and other protrusions from the exterior walls) shown in the Alternative Component Package for the specified range of shading coefficients for the glazing.
2. For low-rise office Alternative Component Packages D, E, & F, and high-rise office Alternative Component Packages, the area of glazing on west-facing exterior walls shall be no more than the percentage of the area of the exterior surface of west-facing exterior walls (excluding parapets, wing walls, and other protrusions from the exterior surfaces of walls) shown in the Alternative Component Package for the specified range of shading coefficients of the glazing.
3. In determining the maximum percentage of glazing allowed under (b)1. and (b)2., if the shading coefficients of different parts of glazing vary, the glazing percentage shall be no more than the value shown, for the area-weighted average of the shading coefficients of the glazing.
4. For the purpose of complying with Sections 2-5342(b)1. and 2-5342(b)2., glazing in exterior walls be treated as glazing in exterior walls with an overall shading coefficient as shown in Table 2-53TS if:

The glazing in exterior walls is shaded with an opaque exterior overhang that:

- (1) runs the entire horizontal width of the glazing;
- (2) is attached to the exterior wall above the glazing; and
- (3) is located so that the overhang angle, the angle between a vertical line from the bottom of the glazing, and a line from the bottom of the glazing to the outside edge of the overhang, is equal to or greater than the overhang angle shown in Table 2-53TS.

TABLE 2-53TS

	Overhang Angle	Equivalent Shading Coefficient
East/West Facing	30°	0.65
	45°	0.55
North/South Facing	30°	0.60
	45°	0.45

5. For climate zones 1 and 16, all glazing shall have a maximum overall U-value of 0.65 in Alternative Component packages A, B, C, D, E, & F, except for Alternative Component packages for High Rise Offices.

(c) Glazing in Exterior Roofs.

1. Glazing in roofs (skylights) is the light transmissive part of glazing with a plane of installation equal to or less than 60° from the horizontal.
2. If glazing in roofs is installed in conjunction with any of the Alternative Component Packages, the area of glazing in roofs shall be equal to or less than the percentage of the area of its corresponding daylight area for the area of glazing in roofs shown in the Package for the shading coefficient range shown.
3. Daylit area for area glazing in roofs is the area on any floor lit by said glazing and enclosed by the following boundaries:
 - A. Any floor-to-ceiling interior or exterior wall or vertical partition whose area is 30 inches or more above the floor has an area-averaged visible light transmission of less than 40%;
 - B. Vertical planes that are parallel to the edges of the ceiling opening of the glazing, and whose horizontal distance from the vertical line from the center of the glazing to the floor is the lesser of (1) or (2) below:
 - (1) The sum of: the horizontal distance from the vertical line through the center of the glazing to the midpoint of the edge of the ceiling opening, plus three quarters of the floor-to-ceiling height.
 - (2) The vertical distance from the floor to the exterior plane of the roof measured along the vertical line from the center of the glazing.

4. Daylit area for glazing in roofs does not include daylit areas for glazing in exterior walls when the lights directly above that area are controlled by daylighting controls that respond to light from the glazing in exterior walls.
 5. If an area is lit by two or more separate glazings, it shall be accounted for as daylit area for only one of the glazings.
 6. Glazing in roofs with a shading coefficient of 1.00 to 0.51 shall have a visible light transmission of at least 70 percent. Glazing in roofs with a shading coefficient of 0.50 to 0.01 shall have a visible light transmission of at least 25 percent.
 7. For climate zones 1 and 16, all glazing shall have a maximum overall U-value of 0.65 in all Alternative Component Packages, except for Alternative Component Packages for High Rise Offices.
- (d) Lighting. Lighting, as adjusted in accordance with equation 2-53S, shall be limited to (1) the Maximum Adjusted Lighting Power Density (MALPD) less the Package Lighting Reduction (PLR). The MALPD is shown in the Alternative Component Package and described in Section 2-5342(d)1; or (2) the Maximum Adjusted Connected Lighting Load (MACLL) less the Package Lighting Reduction. The MACLL is described in Section 2-5342(d)2.

The lighting power of certain applications of lighting may be excluded as follows:

- ° Theatrical lighting designed specifically to light stages, dance floors and other similar areas, and which incorporate special controls and special effects lighting equipment.
- ° Application of lighting equipment whose visible radiation is used for non-visual purposes. Examples are, but not limited to, agricultural lighting used for purposes of stimulating production or reproduction, drying or curing of paints or resins, and infrared heat lamps for food warming.
- ° Studio lighting for photographic processes.

For purposes of demonstrating Performance Approach Compliance when an exemption is taken within an area, the lighting load for that area shall be the larger of: (a) the actual design wattage of any additional non-exempt lighting for visual tasks, or (b) wattage allotment determined in accordance with provisions of Section 2-5342(d).

1. Maximum Adjusted Lighting Power Density (MALPD) - Whole Building Lighting Approach.
 - A. The lighting watts per square foot of conditioned floor area, as adjusted under Section 2-5342(d)1.B., shall be equal to or less than the Maximum Adjusted Lighting Power Density shown in the

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control credits or reducing lighting power density to meet the Package Lighting Reduction.

- B. For the purpose of demonstrating compliance with Section 2-5342(d)1.A. or 2-5342(d)2., the design lighting power density of the building may be adjusted in accordance with Equation 2-53S.

EQUATION 2-53S

$$\text{ALPD} = \frac{[W_T - (CW_1)(PSAF_1) - (CW_2)(PSAF_2) - \dots - (CW_n)(PSAF_n)]}{\text{CFA}}$$

Where ALPD = adjusted lighting power density

W_T = total lighting watts in building

$CW_{1,2, \dots, n}$ = watts of lighting in space 1, 2, ..., n with controls as specified in Table 2-53T

$PSAF_{1,2, \dots, n}$ = power savings adjustment factor for space 1, 2, ..., n, as specified in Table 2-53T.

CFA = conditioned floor area of the building

- C. If any Alternative Component Package is installed all luminaires lighting surfaces within daylight areas for glazing in roofs shall have daylighting controls meeting the criteria of Notes 4 and 5 of Table 2-53T.

- D. A daylight area is any area that is either (1), (2) or (3) below:

(1) A daylight area for glazing in exterior walls, as defined below: Daylit area for glazing in exterior walls is the smallest area on the floor within the following boundaries:

- A. Any floor-to-ceiling interior or exterior wall or vertical partition, including that of the vertical glazing;
- B. A vertical plane or planes extended perpendicular to the plane of the glazing two feet horizontally distant from end points of the widest horizontal extent of the opening for the glazing in the wall; and
- C. A vertical plane parallel to the greatest horizontal width of the glazing opening in the wall, 15 feet distant from this width on the side of the glazing that is conditioned space.

(2) A daylight area for glazing in roofs, as defined in Section 2-5342(c)3.

(3) A daylight area for both glazing in exterior walls and glazing in roofs.

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TABLE 2-53T
POWER SAVINGS ADJUSTMENT FACTORS FOR SPECIAL LIGHTING CONTROLS^{1,5,9}

Control Type	Power Savings Adjustment Factor ²	Applicable Building Space(s)
Occupant-Sensing Devices ³	0.30	Any single space up to 250 square feet and enclosed by ceiling height partitions. Classrooms, conference rooms, computer rooms, corridors, or waiting rooms of any size.
Occupant-Sensing Devices ^{3,8}	0.50	Storage areas of any size.
Occupant-Sensing Devices ³	0.15	Any space of any size.
Daylighting Controls ⁴		Any daylit space ⁶
Continuous Dimming	0.30	
Stepped Controls	0.20	
Programmable Timing Controls ⁷	0.15	Any space
Lumen Maintenance Controls	0.10	Any space
Lighting Controls ^{4,6} with Occupant Sensing Devices ³	0.44	Any single space up to 250 square feet within daylit spaces, and enclosed by ceiling-height partitions
Occupant-Sensing Devices ³	0.37	Any single space up to 250 square feet and with Lumen Maintenance Controls enclosed by ceiling-height partitions

NOTE NO. 1: No adjustment factor shall be allowed for controls required by an alternative component package or required under provisions of Section 2-5319. Dimming controls of incandescent lamps or luminaires shall not qualify.

NOTE NO. 2: Except as shown, only one adjustment factor may be used for each building space or luminaire, and 50% or more of the luminaire shall be within the applicable space to qualify for the power savings adjustment factor. These controls must be installed in series with the lights and in series with all manual switching devices in order to qualify for an adjustment factor.

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NOTE NO. 3: To qualify for the power savings adjustment factor, occupant-sensing devices shall meet the criteria of A, B, or C in Exception No. 3 to Section 2-5319. Separate sensors and switching must be provided for each enclosed space or area.

NOTE NO. 4: Daylighting controls shall be able to reduce electric power consumption for the controlled lighting, to 50 percent or less of maximum power consumption, shall control all luminaires delivering 50% or more of their light output to surfaces within daylit spaces, and shall not control any luminaire delivering more than 50% of its light output to surfaces outside daylit spaces. In order to receive an adjustment factor for daylighting controls, vertical glazing shall be 3 or more feet in height, at least 80 percent of which shall be 2.5 or more feet above the floor; and horizontal glazing with sash shall be 4 or more square feet in area.

NOTE NO. 5: Lighting controls shall meet the requirements of Section 2-5319.

NOTE NO. 6: The daylit space must be illuminated by either:

- A. Glazing in exterior walls more than 3 feet in vertical extent with its highest edge 4 or more feet above the floor of the daylit area; or
- B. Glazing in roofs with sash, 2 square feet or more in area.

NOTE NO. 7: Programmable timing controls used for credit in conjunction with Table 2-53T must be capable of:

- A. Programming different schedules for weekdays and weekends; and
- B. Temporary override by occupants with automatic return to the original schedules. Override controls shall be readily accessible; and
- C. Providing independent control of each lighting load which is required to be separately controlled in Section 2-5319 as requiring independent control. Exception No. 4 to Section 2-5319 does not apply and provisions of Section 2-5319(c) must be met.

NOTE NO. 8: To qualify for this adjustment factor, the area must be used exclusively for storage and not include spaces where activities such as sales, packing and shipping, or any assembly work occurs.

NOTE NO. 9: When an on-off controller operates a luminaire in a standby mode other than completely off, as may be required for high intensity discharge lamps, the controlled watts equals the "full on" watts minus the standby watts.

2. Optional Calculations for Maximum Adjusted Connected Lighting Load (MACLL) - Tailored Lighting Approach.

The watts of the building's adjusted connected lighting load shall be no more than the maximum (MACLL) less the Package Lighting Reduction (PLR) calculated as indicated below in Section 2-5342(d)2A. For Alternative Component Packages E for lowrise offices and B for highrise offices the provision of daylighting controls for all electric lights lighting daylight spaces may be used in lieu of earning control credits or reducing lighting power density to meet the Package Lighting Reduction. Section 2-5342(d)2 shall be used only if the plans and specifications submitted under Section 1403(a)2.A of Title 20, California Administrative Code, show the occupancy and use in each space.

- A. Calculate the maximum connected lighting load for lighting inside the building envelope as indicated below as a summation of wattage allotments determined for individual areas, rooms, and task locations in the building envelope as shown in the required plans, based on the illuminance category and the room cavity ratio (RCR) calculated as shown in Equation 2-53P. The Maximum Connected Lighting Load may be adjusted in accordance with Equation 2-53S in Section 2-5342(d)1.B. to yield the Maximum Adjusted Connected Lighting Load, MACLL.

EQUATION 2-53P

$$RCR = \frac{5h(L+W)}{LW}$$

Where RCR = room cavity ratio
 L = length of room
 W = width of room
 h = vertical distance from the work plan to the lighting fixture.

For spaces which are not covered by provisions of following Sections 2-5342(d)2A(1), (2), or (3), the appropriate illuminance category shall be selected from the Illuminating Engineering Society (IES) Lighting Handbook, 1981 Application Volume, Figure 2-2, including footnotes and other sections of the IES Lighting Handbook referenced in Figure 2-2 that pertain to the selection of appropriate illuminance categories or illuminances. Tasks which are listed by illuminance in footcandles or lux should be converted to the appropriate illuminance category by using the nearest mid-range illuminance value in Figure 2-2 of the IES Lighting Handbook, 1984 Reference Volume or 1981 Applications Volume. For tasks which cannot be lighted with nonincandescent sources, the allocation shall be based on the next higher illuminance category.

NOTE: Section 2-5342(d)2. does not apply to any space in a hotel or motel or to any space served by the same central HVAC system as a hotel or motel.

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Calculate the allotted watts for each space by multiplying the square feet of area by the watts per square foot value for the selected illuminance category from Table 2-53U. For illuminance categories A, B, C, D, and D/E, the entire space is allotted the designated watts per square foot value for the category. For illuminance category E office tasks, a task-oriented lighting allotment at the designated watts per square foot value for the category is allowed for 50 percent of the each designated task/ambient area and the balance of the designated task/ambient area is allowed a general lighting allotment at one-third the designated watts per square foot value for the category. Each such designated task/ambient area shall be no larger than 100 square feet. For all other tasks at illuminance category E and all tasks at illuminance categories F, G, H and I, the allotted watts per square foot value for the category shall be allowed for only the actual task area as shown on the plans.

The total allotted watts shall be determined as the summation of allotted watts for all A, B, C, D, D/E, and E illuminance category areas plus either the allotted watts or actual design watts, whichever is smaller, for each F, G, H and I illuminance category task area.

Multiple allotments for the same area are allowed if two or more distinctly different lighting systems are required for multiple use of the area and are independently circuited and interlocked to permit only one system to be operated at a time.

- (1) For offices the appropriate illuminance category for each area/activity shall be selected from the Office Lighting American National Standard Practice, ANSI/IES RP-1 1982.

Areas or tasks designated for illuminance category E or higher shall be based upon the needs of the specific tenant occupying the permitted space.

Areas designated for illuminance category F and higher shall be identified on the plans and specifications submitted under Section 1403(a)2.A. of Title 20, California Administrative Code, showing locations of individual tasks and equipment to provide illumination of those tasks.

The illuminance category for visual task requirements selected for each task area shall not be based upon an incidental task or combination of tasks which specify use of a given illuminance category or higher when the incidence of these tasks totals less than two hours per working day.

Selection of a higher level illuminance category to accommodate poor quality tasks shall be permitted only if task quality cannot be improved. Task quality may be improved if the equipment or procedure that produces the poor quality task is controlled by the occupant. Tasks with quality that cannot be improved are generated outside of the control of the

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business of the occupant working with these tasks. A "poor quality task" is a visual task that requires illuminance category "E" or greater and is due to choice of a writing or printing method that produces characters that are of small size or lower contrast than good quality alternatives that are regularly used in offices.

Poor quality tasks include the following:

- Ditto copy
- Thermal copy, poor copy
- Xerography, 3rd generation or greater
- Thermal printer
- Impact printer, 2nd carbon or later
- Typed print, 2nd carbon or later.
- Printing-6 pt type
- Handwritten carbon copies
- Handwritten pencil harder than #2

Examples of good quality alternatives which are regularly used in offices and which may be selected to replace one of the above poor quality tasks include:

- Mimeograph and xerograph copy
- Impact printers with good ribbon
- Typed originals in 8 pt and larger type
- Handwritten originals in #2 pencil or pen

- (2) For retail and wholesale stores, the lighting power level for merchandising and associated service areas of stores as defined in Table 1 of the Illuminating Engineering Society Publication, "RP2" Recommended Practice for Lighting Merchandising Areas, shall be the Table 2-53U watts per square foot listed for the following illuminance categories:

Area or Task:	Illuminance Category:
Gross Sales Area ¹	D/E
Valance ²	F
Feature Displays ³	G
Show Windows	G
All Others	See Section 2-5342(d)2.A above.

NOTE NO. 1: Gross sales area equals the total of merchandise, display, sales transaction, fitting room and associated circulation and entry areas.

NOTE NO. 2: Valance lighting is defined, for the purpose of determining its power allotment, as a system of luminaires arranged to provide accent lighting power illumination along a

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wall surface. The valance lighting power allotment equals the task-oriented watts per square foot value shown for illuminance category F and RCR 0 to 3.5 multiplied by the area formed by multiplying a two foot wall surface height times the fluorescent luminaire length. This is equivalent to 10 watts per linear foot times the fluorescent luminaire length.

Detailed dimensioned documentation on plans must be shown when an allotment is taken for more than one tier of valance luminaires. To qualify as a separate tier, a minimum of 2 feet vertical separation between valances must exist. For valance lighting systems using non-fluorescent types of luminaires, the area used for the allotment shall be calculated as the length of accented wall times two feet wall surface height.

NOTE NO. 3: Feature display is defined as an item or items requiring special highlighting to visually attract attention and set apart from the surrounding area. Such items in stores larger than 1,000 square foot are not a part of merchandise directly accessible to customers.

The lighting power allotment for feature display shall be:

- a. The greater of 1000 watts or the wattage determined by multiplying the Table 2-53U watts per square foot value times 5 percent of the gross sales area; and
- b. Where lighting is provided for wall mounted feature displays, a separate additional allotment equal to the wattage determined by multiplying the Table 2-53U watts per square foot value times 10 percent of the total wall area in the gross sales area, excluding fitting rooms. When valance lighting is installed, the wall display allotment calculation shall exclude an area equal to the valance length times six feet for the first tier and times two feet for subsequent tiers of valance.

The watts per square foot value shall be determined as a weighted average of the Table 2-53U values based upon the actual number of displays in each task area/throw distance category.

In areas where luminaires must be at or above 15 foot mounting heights the allotment may be increased by the following multipliers:

Required Mounting Height (Feet)	Multiplier
15	1.15
16	1.21
17	1.47
18	1.65
19	1.84
20	2.04

Allotments calculated for floor mounted displays and wall mounted displays are separate and any excess wattage above what is actually installed for one may not be added to the allotment of the other:

Areas established for determining feature display allotments need not be excluded from calculation of gross sales area allotment. Feature display allotments are in addition to the gross sales area allotment.

EXCEPTION NO. 1: If detailed documentation of actual areas with specific dimensions of all feature displays and each luminaire designated for each of these displays is provided, the feature display allotment may be used up to a maximum of 10 percent of the gross sales area.

EXCEPTION NO. 2: If very valuable merchandise, not directly accessible to the customer, is presented as feature displays in floor mounted, counter cases that are externally lighted from above; an allotment of 20 watts per square foot times the actual area of lighted case top may be used. Detailed documentation on plans must show actual placement with specific dimensions of enclosed counter display cases and each luminaire designated to provide lighting for each case.

NOTE: Very valuable merchandise includes: jewelry, rare coins, small art objects and similar items where selling involves customer inspection of very fine detail from outside of a locked counter case.

- (3) For restaurants, the lighting power level for dining areas and associated service areas shall be the Table 2-53U watts per square foot listed for the following illuminance categories.

2-5342(d)2. - "Tailored Lighting"

<u>Area or Task</u>	<u>Designate as Illuminance Category</u>
Dining Areas	D ¹
Cashier (except quick service)	D
Cashier and Counter Area (quick service)	D/E
Cleaning	D
Displays (including food, artworks, and highlighted building surfaces)	G ^{2,3}
Kitchen Tasks (including food preparation and dishwashing)	E
Entrance Foyer and Lounge	D

NOTE NO.1 Wattage allocations for dining spaces may be increased by 20 percent when dimming controls (manual or automatic) are provided for incandescent sources.

NOTE NO.2 When feature displays, artworks, theme displays, or architectural surfaces are to be highlighted, the Merchandise Lighting Standard wattage allocations shall be applied. For purpose of compliance, the term "public area" shall be substituted for "gross sales area". "Public area" to include all dining, circulation, and other areas to public access excluding areas of separate restrooms, separate banquet rooms and separate lounge areas which are without displays.

NOTE NO.3 An ornate chandelier may be considered an internally lighted display for the purpose of compliance. An ornate chandelier is an internally lighted, decorative, display luminaire composed of clusters of individual crystal, crystalline, or other specularly reflecting, refracting, diffracting, and/or transparent elements whose purpose is to multiply the number of apparent small light sources. To qualify as an ornate chandelier for the purposes of compliance, the chandelier body must also have a maximum vertical extent (height) of more than 14 inches and a total combined maximum vertical (height) and maximum horizontal (width or diameter) extent greater than 50 inches. The wattage allocation for ornate chandeliers shall be 20 watts per cubic foot based on the maximum dimensions of the chandelier body.

TABLE 2-53U. WATTS PER SQUARE FOOT VALUES APPLICABLE TO OFFICES, RETAIL & WHOLESALE STORES

Illuminance Category**	Watts Per Square Foot			See Note
	RCR 0 to 3.5	RCR 3.5+ to 7	RCR 7+	
A(3)	.2	.3	.4	-
B(7.5)	.4	.5	.8	-
C(15)	.6	.8	1.2	-
D(30)	1.2	1.5	1.8	-
D/E(30-75)	2.2	2.8	3.5	-
E(75)	2.8	3.6	4.7	1
F(150)	5.0	6.0	10.1	2

	Task Area		See Note
	Task Area < 2 ft ² OR Throw Distance* > 8 ft	Task Area > 2 ft ²	
G(300)	26	13	2
H(750)	63	33	2
I(1,500)	130	65	2

* "Throw Distance" is defined as distance, documented on plans, between luminaire and center of lighted plan on a feature display.

** Numbers in parentheses are the mid-range footcandle levels for the illuminance category.

NOTE NO. 1: The allotted watts are for task-oriented lighting and shall be calculated from the actual area of the task, except for office tasks specified in Section 2-5342(d)2.A. If no specific task or activity can be assigned to the area surrounding the task, then such areas shall be designed "non task" and allotted one third of the task value watts per square foot.

NOTE NO. 2: Lighting for these tasks or retail feature displays shall be obtained by local lighting, and shall be confined to the specific task area, which shall be described. For store feature displays, in lieu of description of specific task areas, the location of each feature display and identification of its lighting equipment shall be shown on plans. Any lighting power allotment determined for these tasks, that is more than the lighting power level actually installed, shall not be applied to other task areas. Square footage of areas designated for these tasks need not be subtracted when calculating the lighting allotment for the space which contains the illuminance category F, G, H or I Tasks.

(e) Space Conditioning Systems:

Space conditioning systems installed as part of an Alternative Component Package shall meet the control and sizing requirements of Section 2-5342(e)1., and shall meet one of the alternative sets of space conditioning performance criteria of Section 2-5342(e)2. or the requirements of Section 2-5342(e)3.

1. Control and Sizing Requirements for Space Conditioning Systems.

- A. All HVAC systems installed as part of an Alternative Component Package shall include an integrated temperature or enthalpy economizer cycle or integrated water economizer cycle; or a separate ventilation system(s) capable of supplying outdoor air for ventilation and capable of bringing in outside air under thermostatic control while locking out other mechanical heating or cooling systems. The economizer shall be capable of operating and providing partial cooling, even when additional mechanical cooling is required to meet part of the load.

EXCEPTION NO. 1: Systems of less than 3,000 CFM peak supply air volume and direct expansion cooling systems of 15 tons or less nominal cooling capacity may use an economizer that is not able to provide partial cooling when mechanical cooling must operate simultaneously.

EXCEPTION NO. 2: Systems with air or evaporatively cooled condensers that include air treatment equipment installed to meet or exceed the requirements of Section 6.1.2 of ASHRAE 62-1981.

EXCEPTION NO. 3: The system serves only perimeter zones of which less than 20% of the zone areas are located more than 15 feet from an exposed exterior wall.

EXCEPTION NO. 4: Systems with no mechanical cooling capability.

EXCEPTION NO. 5: The total capacity of cooling systems without economizers serving the building is less than 5% of the total installed cooling capacity.

EXCEPTION NO. 6: The system has specific equipment shown in the plans and specifications for dehumidification or humidification and serves a process other than human comfort that requires humidity control for the whole area served by the HVAC system.

- B. All HVAC systems that are installed as part of an Alternative Component Package shall:

- (1) provide thermostatic controls for each zone which control the supply of heating and cooling to that zone independently of other zones.

EXCEPTION: Independent perimeter systems may serve multiple zones of the primary/interior system with the following limitations:

- a. The perimeter system shall include at least one thermostatic control zone for each major building exposure. A major building exposure is an area of the building which contains exterior walls all facing one of the cardinal orientations, north, east, south, or west (as defined in Section 2-5302) for 50 contiguous feet or more. Minor exposures, those with exterior walls facing one cardinal orientation for less than 50 contiguous feet, may be served by an adjacent perimeter system control zone whose exterior wall orientation is no greater than 90 degrees from the orientation of the minor exposure.
 - b. The perimeter system heating and/or cooling supply shall be controlled by thermostat(s) located within the zones(s) served by the system.
- C. Systems that reheat, recool, mix warm and cold air streams, or otherwise operate heating and cooling systems serving the same zone or zones simultaneously, shall meet the requirements of (1) or (2) below:

- (1) The systems are variable air volume systems which, during periods of occupancy, are designed to reduce the volumetric air flow to each zone to a minimum before reheating, recooling, or mixing takes place. This minimum volumetric flow shall be no greater than the larger of the following:
 - a. thirty percent (30%) of the peak supply volumetric flow.
 - b. the minimum required to meet ventilation requirements of Section 2-5343.
 - c. 0.4 cubic feet per minute per square foot of zone conditioned floor area.

The system shall also include controls which automatically reset supply air temperature by representative building loads or by outside air temperature. Temperature shall be capable of being reset by at least 25% of the design supply air to room air temperature difference. Zones which are expected to experience relatively constant loads, such as interior zones, shall be designed for the fully reset supply air temperature.

- (2) The energy used for reheating, recooling, or heating warm air in mixing systems is provided entirely from nondepletable energy sources or energy recovered from lighting, heating, cooling, water heating or processes which would otherwise be wasted.

- D. Variable Air Volume systems installed as part of an Alternative Component Package shall include supply fan(s) (and return fan(s), if present) that
- (1) are capable of reducing the total air flow as a function of the total heating or cooling load, and
 - (2) have a part load performance such that the fan wattage index, when supply fans (and return fans, if present) are operating at 50 percent of volumetric flow for the design cooling load, is less than 50 percent of the fan wattage index (FWI) listed for the HVAC Power Criteria Set selected.
2. HVAC Power Criteria. Any HVAC system installed as part of an Alternative Component Package shall meet one of the sets of performance criteria listed in the Alternative Component Package. There is only one set of performance criteria for Alternative Component Packages in offices of four or more stories. Please note that all site energy consumed shall be converted to source energy as per Table 2-53C in Section 2-5303(b).
- A. Source heating power indices, HPIS, shall be calculated as shown in Equation 2-53U, when all energy power inputs are converted to Btu/hr in accordance with Table 2-53C.

EQUATION 2-53U

$$HPI_s = \frac{(E_1 + E_2 + E_3 + \dots + E_n)}{CFA}$$

Where

HPI_s = Source Heating Power Index

$E_{1,2,\dots,n}$ = Source Energy inputs (in source Btu/hr) for all HVAC components used to deliver heat to the building at the efficiency rating conditions for the equipment, including, but not limited to, those to the furnace, pumps, all fans, heat pumps, boilers, and packaged HVAC units used to deliver or distribute heat to the zones. The energy inputs shall also include return fans used to bring recirculated air back to the HVAC system. For fans, the source energy inputs may be determined based on the design heating load. For all other heating equipment, these inputs are based on the actual size of equipment designed and installed. The energy inputs need not include exhaust fans or other equipment that are not part of the HVAC heating system(s).

CFA = the conditioned floor area of the building in ft².

- B. Source cooling power index, CPI_s , shall be calculated as shown in Equation 2-53W, where all energy power inputs are converted to Btu or Btu/hr in accordance with Table 2-53C.

EQUATION 2-53V

$$CPI_s = \frac{(E_1 + E_2 + \dots + E_n)}{CFA}$$

Where

CPI_s = Source Cooling Power Index

$E_1, 2, \dots, n$ = Source energy inputs (in source Btuh) for all HVAC components used to remove heat from the building zones as the efficiency rating conditions for the equipment, including, but not limited to, those cooling towers, chillers, condensers, fans, pumps, heat pumps, packaged HVAC units, and supply and return fans, and duct systems. For fans, the source energy inputs may be determined based on the design cooling load. For all other cooling equipment, these inputs are based on the size of equipment designed and installed. It need not include exhaust fans or other equipment that are not part of the HVAC cooling system(s).

CFA = the conditioned floor area of the building in ft^2 .

The CPI_s may be adjusted as shown in Equation 2-53W for process loads as defined in Section 2-5304(d)4.C.(3).

EQUATION 2-53W

$$CPI_{as} = CPI_s \times [1 - (H_p/H_t)]$$

Where

CPI_{as} = Adjusted source cooling performance index

CPI_s = Source cooling performance index

H_p = Sensible and latent heat of process loads

H_t = Total sensible and latent heat (including process heat) cooled by the system

- C. The fan wattage index, FWI, for the fans that deliver ventilation air to the zones shall, and return them to the supply fans, be calculated as shown in Equation 2-53X.

EQUATION 2-53X

$$FWI = \frac{(FW_1 + FW_2 + \dots + FW_n)}{CFA}$$

Where

- FWI = fan wattage index
 $FWI_{1,2,\dots,n}$ = the power requirement for each fan, at design cooling conditions, in watts
 CFA = the conditioned floor area of the building in ft^2

The FWI may be adjusted for process loads and for added pressure drop due to specially required treatment (purification) of outside or recirculated air as shown in Equations 2-53Y and 2-53Z below.

EQUATION 2-53Y

$$FWI_{apc} = FWI \times [1 - (H_p/H_t)]$$

Where

- FWI = Fan Wattage Index before adjustment for process loads
 FWI_{apc} = Fan Wattage Index adjusted for process loads
 H_p = Sensible heat of process loads
 H_t = Total sensible heat cooled by the system

EQUATION 2-53Z

$$FWI_{apd} = FWI \times [1 - (P_{at}/P_o)]$$

Where

- P_{at} = Additional pressure drop of equipment (filters, absorption media treatment, or electrostatic precipitation) required for purification of recirculated or outdoor air.
 P_o = Total system pressure drop including special filters, equipment or devices and ordinary filters.
 FWI_{apd} = Fan wattage index adjusted for pressure drop.

- D. If set I of the HVAC system power criteria is used in an office of three or fewer stories, it is required to have a gas-fired furnace for heating, or no heating capability.
- E. For low rise buildings, HVAC alternative set IV is limited to water or evaporatively cooled HVAC systems that can vary the amount of air to each zone separately.

3. As an alternative to meeting the requirements of 2-5342(e)2., load calculations shall be performed and HVAC systems shall be sized and selected in accordance with the following requirements:
 - A. Load Calculations. The loads for heating, ventilating, and air-conditioning equipment shall be calculated in accordance with the procedures and assumptions given below.
 - (1) Procedures. Use ASHRAE Handbook, 1985, Fundamentals Volume or an equivalent computation procedure, for heating and cooling system design loads.
 - (2) Indoors & Outdoor Design Conditions. Use design conditions referenced in Section 2-5303.
 - (3) Ventilation. Use outdoor air ventilation rates referenced in Section 2-5343 or ASHRAE 62-1981 unless special occupancies or processes not specifically referenced in ASHRAE 62-1981, or local codes require greater ventilation rates.
 - (4) Envelope. Envelope heating and cooling loads shall be based upon and be consistent with the proposed design.
 - (5) Lighting. Use lighting power allotments determined in accordance with the requirements of Section 2-5342(d).
 - (6) Other Loads. Assumptions listed in subsections a. and b. below may be used for load calculations for this compliance alternative. The assumptions for budget calculations indicated in Section 2-5304 and the Energy Efficiency Manual and may differ from the assumptions allowed for these load calculations. Use design data compiled from one or more of the following sources:
 - a. In the absence of design specifications, up to 1.0 watt per square foot of miscellaneous electrical loads and the lighting power density allowed by Section 2-5342(d) shall be used. Sensible and latent heat gains per person shall be those used for determining the energy budgets. Occupant densities shall be those specified in Table 3 of ASHRAE 62-1981 for ventilation requirements, for example for offices the occupant density is 7 people per 1000 square feet.
 - b. Actual information or published technical information, based on the intended use of the building as documented on the plans and in the specifications for the design shall be used. Internal process loads in excess of a. above must be documented and must correspond to special features in the plans and specifications providing for such high additional loads.

Internal heat gains may be ignored for heating load calculations.

- B. System and Equipment Sizing and Selection. Select HVAC systems and equipment no larger than 150% of the cooling load no more than 180% of the heating load when the loads have been calculated in accordance with the procedures specified above in subsection A, Load Calculations.

EXCEPTION NO. 1: Stand-by equipment may be installed if controls and devices, as shown on plans and specifications, are provided which allow stand-by equipment to operate automatically only when the primary equipment is not operating.

EXCEPTION NO. 2: Multiple units of the same equipment type, such as multiple chillers and boilers, with combined capacities exceeding the design load may be specified to operate concurrently only if controls are provided, as shown on plans and specifications, which sequence or otherwise optimally control the operation of each unit based on load.

EXCEPTION NO. 3: For a single piece of equipment which has both heating and cooling capability, only one function, either the heating or the cooling, need meet the requirements of this section. Capacity for the other function shall, within available equipment options, either meet these requirements or be the smallest available size necessary to meet the load.

- C. Power Consumption of Fans. The ventilation system shall meet the requirements of Section 2-5332.
- D. Electric Resistance Heating. Electric resistance heating systems may not be used for space heating.

EXCEPTION NO. 1: The electric resistance system is used to supplement a heating and/or cooling system by which at least 60 percent of the annual energy requirement is supplied by a device using a nondepletable source of energy.

EXCEPTION NO. 2: The electric resistance heating equipment is the supplementary electric resistance equipment for a heat pump system.

EXCEPTION NO. 3: The capacity of the electric resistance heating system is less than 10 percent of the capacity of the total heating system.

TABLE 2-53V9
 ALTERNATIVE COMPONENT PACKAGES FOR CLIMATE ZONE #09
 FOR LOW-RISE OFFICE BUILDINGS

Component	PACKAGE					
	A	B	C	D	E	F
OPAQUE ENVELOPE						
Minimum Roof Total R-Value (R_t)	9.52	9.52	12.51	9.50	9.50	12.40
Minimum Opaque Wall Total R-Value (R_t) (one of Heat Capacity [Btu/°F/ft ²])						
0.0 - 3.99	7.52	7.52	3.00	11.00	11.00	8.50
4.0 - 9.99	7.50	7.50	3.00	8.70	8.70	5.30
10.0 - 14.99	4.62	4.62	2.30	4.60	4.60	2.10
15.0 - 19.99	2.30	2.30	1.45	2.60	2.60	1.40
20.0 or more	1.69	1.69	1.20	1.40	1.40	1.40
Minimum Suspended Exterior Floor Total R-Value (R_t)	9.50	9.50	9.50	9.50	9.50	9.50
GLAZING						
Maximum Allowed Total Vertical *** Glazing (one of the following):						
Shading Coefficient						
1.00 - 0.72	21%	21%	21%	22%	41%	22%
0.71 - 0.66	25%	25%	25%	30%	50%	30%
0.65 - 0.56	28%	28%	28%	31%	52%	31%
0.55 - 0.36	36%	36%	36%	34%	54%	34%
0.35 - 0.01	63%	63%	63%	52%	65%	52%
See Section 2-5342(b)5, for overhang equivalents.						
Maximum Allowed Glazing in Roofs as percent of daylit area (one of the following):						
Shading Coefficient						
1.00 - 0.51	6%	6%	6%	6%	6%	6%
0.50 - 0.01	12%	12%	12%	12%	12%	12%
Daylighting Controls are required with Glazing in Roofs						
LIGHTING						
Package Lighting Reduction Maximum Adjusted	None	None	0.10	None	0.24	None
Lighting Power Density, watts per square foot Maximum Adjusted	1.50	1.50	1.50	1.50	1.50	1.50
Connected Lighting Load	*	*	*	*	*	*
SPACE CONDITIONING SYSTEM (Both Heating and Cooling:)						
General Requirements	**	**	**	**	**	**
MEET THE						
HVAC Power Criteria (select one of columns I, II, III, or IV; any column may be used in any Alternative Component Package; see Section 2-5342(e)2. for additional requirements)						
	I	II	III	IV		
Fan Wattage Index	0.53	0.50	1.14	1.87		
Source Heating Power Index	108.3	90.5	33.0	43.2		
Source Cooling Power Index	54.3	49.1	44.7	59.4		
* See Section 2-5342(d)2.						
** See Section 2-5342(e)1.						
*** See Section 2-5342(b)2. also						

OR

MEET THE SIZING AND EQUIPMENT SELECTION CRITERIA IN SECTION 2-5342(e)3.

```
#####  
#####  
##  
## ALL ALTERNATIVE COMPONENT PACKAGES IN SECTION ##  
## 2-5342 (TABLES 2-53V1 TO V16, TABLES 2-53W1 TO ##  
## W16, AND TABLES 2-53WA1 TO WA16) WILL HAVE THE ##  
## SAME AMENDMENTS SHOWN FOR TABLE 2-53V1. ##  
## ##  
## TABLE 2-53V8 HAS SPECIAL AMENDMENTS TO CORRECT ##  
## PREVIOUS ERRORS IN THAT TABLE. ##  
## ##  
#####  
#####
```

Table 2-53V1 showing the changes typical for Tables 2-53V1 to 2-53V16, Tables 2-53W1 to 2-53W16, and Tables 2-53WA1 to 2-53WA16 is on the preceding page. New Tables 2-53V8 and 2-53V9 shown here for other corrections also shows this change that officially allows the HVAC sizing and selection method of Section 2-5342(e)3. to be used in lieu of the HVAC power criteria of Section 2-5342(e)2. This method has been allowed as an Alternative Component Package since November 1987 but is now formally incorporated into the standards.

TABLE 2-53V8
ALTERNATIVE COMPONENT PACKAGES FOR CLIMATE ZONE #08
FOR LOW-RISE OFFICE BUILDINGS

Component	PACKAGE					
	A	B	C	D	E	F
OPAQUE ENVELOPE						
Minimum Roof Total R-Value(R_t)	9.52	9.52	12.51	9.50	9.50	9.50
Minimum Opaque Wall Total R-Value (R_t) (one of the following):						
Heat Capacity [Btu/°F/ft ²]						
0.0 - 3.99	7.52	7.52	3.00	11.00	11.00	8.50
4.0 - 9.99	7.50	7.50	3.00	8.70	8.70	5.30
10.0 - 14.99	4.62	4.62	2.30	4.60	4.60	2.10
15.0 - 19.99	2.30	2.30	1.45	2.60	2.60	1.40
20.0 or more	1.69	1.69	1.20	1.40	1.40	1.40
Minimum Suspended Exterior Floor Total R-Value (R_t)	9.50	9.50	9.50	9.50	9.50	9.50
GLAZING						
Maximum Allowed Total Vertical *** Glazing (one of the following):						
Shading Coefficient						
1.00 - 0.72	21%	21%	21%	22%	41%	22%
0.71 - 0.66	25%	25%	25%	30%	50%	30%
0.65 - 0.56	28%	28%	28%	31%	52%	31%
0.55 - 0.36	36%	36%	36%	34%	54%	34%
0.35 - 0.01	63%	63%	63%	52%	65%	52%
See Section 2-5342(b)5, for overhang equivalents.						
Maximum Allowed Glazing in Roofs as percent of daylit area (one of the following)						
Shading Coefficient						
1.00 - 0.51	6%	6%	6%	6%	6%	6%
0.50 - 0.01	12%	12%	12%	12%	12%	12%
Daylighting Controls are required with Glazing in Roofs						
LIGHTING						
Package Lighting Reduction	None	None	0.10	None	0.24	None
Maximum Adjusted Lighting Power Density, watts per square foot	1.50	1.50	1.50	1.50	1.50	1.50
Maximum Adjusted Connected Lighting Load	*	*	*	*	*	*
SPACE CONDITIONING SYSTEM (Both Heating and Cooling:)						
General Requirements	**	**	**	**	**	**
MEET THE						
HVAC Power Criteria (select one of columns I, II, III, or IV; any column may be used in any Alternative Component Package; see Section 2-5342(e)2. for additional requirements)						
	<u>I</u>	<u>II</u>	<u>III</u>	<u>IV</u>		
Fan Wattage Index	0.50	0.49	1.04	1.53		
Source Heating Power Index	101.3	96.0	30.90	37.9		
Source Cooling Power Index	51.8	41.30	41.35	56.7		
* See Section 2-5342(d)2.						
** See Section 2-5342(e)1.						
*** See Section 2-5342(b)2. also						

OR

MEET THE HVAC SIZING AND EQUIPMENT SELECTION CRITERIA IN SECTION 2-5342(e)3.

TABLE 2-53V1
ALTERNATIVE COMPONENT PACKAGES FOR CLIMATE ZONE #01
LOW-RISE OFFICE BUILDINGS

Component	PACKAGE					
	A	B	C	D	E	F
OPAQUE ENVELOPE						
Minimum Roof Total R-Value (R_t)	12.51	12.51	15.24	12.4	12.4	15.00
Minimum Opaque Wall Total R-Value (R_w) (one of the following):						
Heat Capacity [Btu/°F/ft ²]						
0.0 - 3.99	7.52	7.52	5.15	11.0	11.0	5.10
4.0 - 9.99	7.38	7.38	3.46	10.2	10.2	4.50
10.0 - 14.99	6.63	6.63	2.98	8.6	8.6	3.60
15.0 - 19.99	5.97	5.97	2.77	7.7	7.7	3.20
20.0 or more	5.51	5.51	2.49	7.2	7.2	3.10
Minimum Suspended Exterior Floor Total R-Value (R_t)	9.50	9.50	9.50	9.5	9.5	9.50
GLAZING (Special Glazing is required for Climate Zone 01)						
Maximum Allowed Total Vertical *** Glazing (one of the following):						
Shading Coefficient						
1.00 - 0.72	25%	25%	25%	26%	37%	26%
0.71 - 0.66	27%	27%	27%	30%	42%	30%
0.65 - 0.56	29%	29%	29%	34%	48%	34%
0.55 - 0.36	32%	32%	32%	37%	47%	37%
0.35 - 0.01	41%	41%	41%	47%	56%	47%
See Section 2-5342(b)5, for overhang equivalents.						
Maximum Allowed Glazing in Roofs as percent of daylit area (one of the following):						
Shading Coefficient						
1.00 - 0.51	7%	7%	7%	7%	7%	7%
0.50 - 0.01	11%	11%	11%	11%	11%	11%
Daylighting Controls are required with Glazing in Roofs						
LIGHTING						
Package Lighting Reduction	None	None	0.10	None	0.24	0.10
Maximum Adjusted	1.50	1.50	1.50	1.50	1.50	1.50
Lighting Power Density, watts per square foot						
Maximum Adjusted	*	*	*	*	*	*
Connected Lighting Load						
SPACE CONDITIONING SYSTEM (Both Heating and Cooling:)						
General Requirements	**	**	**	**	**	**

MEET THE

HVAC Power Criteria (select one of columns I, II, III, or IV; any column may be used in any Alternative Component Package; see Section 2-5342(e)2. for additional requirements)

	I	II	III	IV
Fan Wattage Index	43	0.45	1.00	1.30
Source Heating Power Index	88.6	91.6	33.0	37.4
Source Cooling Power Index	36.7	31.0	32.5	36.9

* See Section 2-5342(d)2.

** See Section 2-5342(e)1.

*** See Section 2-5342(b)2. also

OR

MEET THE SIZING AND EQUIPMENT SELECTION CRITERIA IN SECTION 2-5342(e)3.

```
#####  
#####  
##  
##          ALTERNATIVE COMPONENT PACKAGES          ##  
##          DESCRIBED IN TABLES 2-53WA1 TO 2-53WA16  ##  
##          HAD A PRINTING ERROR IN THE 1987 EDITION  ##  
##          OF THE STANDARDS (P400-88-001).          ##  
##          THE CORRECTED TEXT INDICATED IN THE SAMPLE TABLE ##  
##          2-53WA1 SHOWN BELOW IS TYPICAL FOR ALL 16 TABLES, ##  
##          2-53WA1 THROUGH 2-53WA16.                ##  
##  
#####  
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The changes shown to the Retail & Wholesale Store Alternative Component Packages, Tables 2-53WA1 through 2-53WA16 show that the "Lighting Control Reduction Required" portions of the Packages were repealed as part of the changes adopted by the California Energy Commission in 1987. Hence there is no required lighting control reduction. This requirement was replaced by the more flexible "Package Lighting Reduction" which allows less lighting, lighting controls, or more efficient lighting to meet a similar lighting power goal. Note that these packages also allow the HVAC sizing and selection criteria of Section 2-5342(e)3. to be used in lieu of the HVAC Power Criteria in Section 2-5352(e)2.

TABLE 2-53WA1
ALTERNATIVE COMPONENT PACKAGES FOR CLIMATE ZONE #01
FOR RETAIL AND WHOLESALE STORES

Component	PACKAGE			
	A	B	C	D
OPAQUE ENVELOPE				
Minimum Roof Total R-Value (R_t)	12.51	12.51	15.24	12.51
Minimum Opaque Wall Total R-Value (R_t) (one of the following):				
Heat Capacity [Btu/°F/ft ²]				
0.0- 3.99	7.52	7.52	5.15	7.52
4.0- 9.99	7.38	7.38	3.46	7.38
10.0-14.99	6.63	6.63	2.96	6.63
15.0-19.99	5.97	5.97	2.77	5.97
20.0 or more	5.51	5.51	2.49	5.51
Minimum Suspended Exterior Floor Total R-Value (R_t)	9.50	9.50	9.50	9.50
GLAZING (Double Glazing is required for Climate Zone #01)				
Maximum Allowed Total Vertical Glazing (one of the following):				
Shading Coefficient				
1.00-0.72	25%	25%	25%	6.0%
0.71-0.66	27%	27%	25%	6.1%
0.65-0.56	29%	29%	29%	6.5%
0.55-0.36	32%	32%	32%	7.3%
0.35-0.01	41%	41%	41%	8.5%
See Section 2-5342(b)5 for overhang equivalents.				
Maximum Allowed Glazing in Roofs as percent of daylit area (one of the following):				
Shading Coefficient				
1.00-0.51	11%	11%	11%	11%
0.50-0.01	16%	16%	6%	16%
Daylighting Controls are required for Glazing in Roofs				
LIGHTING				
Package Lighting Reduction	None	None	0.20	0.40
Maximum Adjusted Lighting Power Density, watts per square foot	2.00	2.00	2.00	2.90
Maximum Adjusted Connected Lighting Load	See Sec. 2-5342(d)2	See Sec. 2-5342(d)2	See Sec. 2-5342(d)2	See Sec. 2-5342(d)2
Lighting Control Reduction Required -(W/SF)	None	None	0.2	None
SPACE CONDITIONING SYSTEM (Both Heating & Cooling:)				
General Requirements	See Sec. 2-5342(e)1	See Sec. 2-5342(e)1	See Sec. 2-5342(e)1	See Sec. 2-5342(e)1

MEET THE

HVAC Power Criteria (select one of columns I, II, or IV; any column may be used in any Alternative Component Package; see Section 2-5342(e)2 for additional requirements)

	I	II	IV
Fan Wattage Index	0.44	0.46	1.21
Source Heating Power Index	95.9	93.3	29.3
Source Cooling Power Index	31.5	31.1	41.5

OR

MEET THE SIZING AND EQUIPMENT SELECTION CRITERIA IN SECTION 2-5342(e)3.

