



Energy Building Regulations for New Residential and Nonresidential Buildings

For historical reference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

New Residential Buildings

Adopted by the
California Energy Commission
on July 15, 1981
and to become effective on
July 13, 1982

California
Energy
Commission

Conservation
Division

Item Code: P400-81-005

CALIFORNIA ADMINISTRATIVE CODE

BUILDING REGULATIONS

APPLICABLE TO

RESIDENTIAL BUILDINGS

(Excluding apartment houses with four
or more habitable stories and hotels)

Effective July 13, 1982 .

<u>Sections</u>	<u>Subject</u>	<u>Pages</u>
1401 through 1410	Administrative Regulations	1-1 through 1-14
2-5301 through 2-5307	Building Regulations applicable to all occupancies	2-1 through 2-26
2-5351 through 2-5352	Building Regulations applicable to new residential buildings.	2-28 through 2-57
4-1000	Building Regulations applicable to ducts.	4-1 through 4-2

CALIFORNIA ADMINISTRATIVE CODE

Title 20

Chapter 2
(California Energy Commission)

Subchapter 4
(Conservation)

Article 1
(Energy Building Regulations)

TABLE OF CONTENTS

<u>Section</u>	<u>Title</u>	<u>Page</u>
1401	<u>General</u>	1-4
1402	<u>Definitions</u>	1-4
1403	<u>Permit Requirements for New Buildings</u>	1-5
(a)	Design and Compliance Requirements for Nonresidential Buildings	1-5
(b)	Enforcement Agency Requirements for Residential Buildings	1-6
(c)	Statement of Design Compliance for Residential Buildings	1-6
(d)	Insulation Certificate	1-6
(e)	Occupant Information for Residential Buildings	1-6
(f)	Identification of Complying HVAC Equipment	1-7
(g)	Electric Resistance Comfort Heating Equipment	1-7
(h)	Maintenance Information	1-7
(i)	Responsibility of Equipment Suppliers	1-7
(j)	Exceptional Designs, Materials, and Devices for Residential Buildings, Except Apartment Houses with Four or More Habitable Stories and Hotels	1-7
(k)	Other Documentation Requirements for Nonresidential Buildings	1-8
1404	<u>Permit Requirements for Additions, Alterations, and Repairs</u>	1-8
(a)	General	1-8
(b)	Insulation Certificate	1-8
1405	<u>Enforcement by the Commission</u>	1-9
(a)	Where There is No Local Enforcement Agency	1-9
(b)	Where the Local Enforcement Agency Fails to Enforce	1-9
1406	<u>Locally Adopted Energy Standards</u>	1-9
(a)	Requirements	1-9
(b)	Documentation	1-9
(c)	Staff Recommendations	1-10
(d)	Hearing	1-10
1407	<u>Interpretations</u>	1-10
1408	<u>Claims of Exemption</u>	1-11
(a)	Requirements	1-11

<u>Section</u>	<u>Title</u>	<u>Page</u>
(b)	Documentation	1-11
(c)	Staff Recommendations	1-11
(d)	Hearing	1-12
1409	<u>Approved Calculation Methods</u>	1-12
(a)	Public Domain Computer Program	1-12
(b)	Simplified Calculation Method	1-12
(c)	Certification of Alternative Calculation Methods	1-12
(d)	Certification of Alternative Component Packages	1-13
(e)	Publication of Commission Determinations	1-13
1410	<u>Appeal to Commission</u>	1-14

ARTICLE 1.--ENERGY BUILDING REGULATIONS

Section 1401. General.

This article contains administrative regulations relating to the energy building regulations found in Title 24, Part 2, Chapter 2-53.

NOTE: Authority cited: Public Resources Code, Sections 25402 and 25402.1

Reference: Public Resources Code, Sections 25402 and 25402.1

Section 1402. Definitions.

For the purpose of this article the following definitions shall apply:

"Approved calculation method" means the California Energy Commission's Public Domain Computer Program, one of the Commission's Simplified Calculation Methods, or any other calculation method approved by the Executive Director.

"Commission" means the State Energy Resources Conservation and Development Commission.

"Conditioned floor area" means the floor area of conditioned space on all floors, including basements, intermediate floor tiers, and penthouses, measured from the exterior faces of exterior walls and the exterior face of walls separating conditioned and unconditioned spaces. Conditioned floor area does not include covered walkways, open roofed-over areas, porches, pipe trenches, exterior terraces or steps, chimneys, roof overhangs, parking garages, unheated basements, and closets for central gas forced air furnaces.

"Conditioned space" means the space, within a building, which is provided with a heat supply or a method of cooling, either of which has connected output capacity in excess of 10 Btu/hr per square foot.

"Enforcement agency" means the city, county, or state agency responsible for issuing a building permit.

"Executive Director" means the Executive Director of the Commission.

"Governmental agency" means any public agency or subdivision thereof, including any agency of the state, county, city, district, association of governments, and joint power agency.

"Nonresidential building" means any building which is of an occupancy type A, B, E, and/or H as defined in the Uniform Building Code, 1979 Edition.

"Public Adviser" means the Public Adviser of the Commission.

"Residential building" means a building which is of an occupancy type R as defined in the Uniform Building Code, 1979 edition.

"Thermal resistance (R)" means the measure of the resistance of a material or building component to the passage of heat in $\frac{\text{hr} - \text{ft}^2 - ^\circ\text{F}}{\text{Btu}}$.

NOTE: Authority cited: Public Resources Code, Section 25402
Reference: Public Resources Code, Section 25402

Section 1403. Permit Requirements for New Buildings.

(a) Design and Compliance Requirements for Nonresidential Buildings.

- (1) Design. With each application for a building permit, in addition to two sets of plans and specifications, the calculations, reports, and other required documentation shall be signed by the particular licensed or registered professional responsible for their preparation. They shall include a civil engineer, mechanical engineer, electrical engineer, architect, building designer, general engineering contractor, general building contractor or specialty contractor, licensed or registered to practice by the State of California.

The designer shall provide a statement on the drawings, over his signature, that these regulations have been reviewed and the design submitted conforms substantially with these regulations.

The enforcement agency may waive any of the requirements of this subsection for buildings having a gross square feet of conditioned floor area not exceeding 1,000 square feet and an occupant load not exceeding 49 persons.

- (2) Construction Compliance. At the time of request for final inspection for any project subject to these regulations, the permittee or his authorized agent for the project shall deliver to the enforcement agency a certificate of construction compliance with these standards based on observation of construction and signed by one or more of the following: the owner, general building contractor, design architect, design engineer, or an approved independent inspector or inspection agency. This report shall indicate, based upon personal knowledge, that the work performed and the materials used and installed appear in every material respect in compliance with the approved plans and specifications for which the building permit was issued.

Such written report shall be filed prior to approval of the building for occupancy by the enforcement agency.

The term "personal knowledge" as used in this section means the personal knowledge which is obtained from periodic visits to the

project site of reasonable frequency for the purpose of general observation of the work and also which is obtained from the reporting of others as to the progress of the work, testing of materials, inspection, and superintendence of the work that is performed between the above-mentioned periodic visits. The exercise of reasonable diligence to obtain the facts is required.

- (3) Nothing in this section shall be construed as limiting in any manner the responsibility of the enforcement agency for reviewing the plans of proposed nonresidential buildings to confirm that they comply with these regulations.

- (b) Enforcement Agency Requirements for Residential Buildings. An enforcement agency shall not issue a building permit or renew an existing permit which was applied for on or after the effective date of this article for any new residential building unless the enforcement agency determines, in writing, that the new building is designed to comply with the requirements of Title 24, Part 2, Chapter 2-53.

The enforcement agency shall require that every application for a building permit contain plans and specifications with adequate detail for determining compliance with the requirements of Title 24, Part 2, Chapter 2-53.

The enforcement agency shall inspect new buildings to ensure that they are constructed according to the agency's approved plans and that the buildings meet the applicable requirements of Title 24, Part 2, Chapter 2-53.

- (c) Statement of Design Compliance for Residential Buildings. The person who designs the building or applies for the building permit shall state on the building plans or submit a written statement with the permit application that the building design meets the requirements of Title 24, Part 2, Chapter 2-53.
- (d) Insulation Certificate (All Occupancies). After installing insulation, the installer shall post in a conspicuous location in the building a certificate signed by the installer and the builder stating that the installation conforms with the requirements of Title 24, Part 2, Chapter 2-53, and that the materials installed conform with the requirements of Title 20, Chapter 2, Subchapter 4, Article 3. The certificate shall state the manufacturer's name and material identification, the installed "R" value, and (in applications of loose fill insulation) the minimum installed weight per square foot consistent with the manufacturer's labeled density for the desired "R" value.
- (e) Occupant Information for Residential Buildings. The builder shall provide the original occupant a list of the heating, cooling, water heating, and lighting systems and conservation or solar devices installed

in the building and instructions on how to use them efficiently. The instructions shall be consistent with specifications set forth by the Executive Director.

- (f) Identification of Complying HVAC Equipment (All Occupancies). The efficiency of the equipment described in Title 24, Part 2, Chapter 2-53, Section 2-5306, shall be shown on the plans or in the documents submitted to the enforcement agency for approval.
- (g) Electric Resistance Comfort Heating Equipment (All Occupancies). The manufacturer of electric resistance comfort heating equipment shall make available to prospective purchasers, designers, or contractors, upon request, full-load energy input over the range of voltages at which the equipment is intended to operate.
- (h) Maintenance Information (All Occupancies). Equipment which requires preventive maintenance for efficient operation shall be furnished with complete necessary maintenance information. Required routine maintenance actions shall be clearly stated and incorporated on an accessible label, which may be limited to identifying, by title and/or publication number, the operation and maintenance manual for that particular model and type of product. At least one copy of this information shall be furnished by the manufacturer for the original owner upon request.
- (i) Responsibility of Equipment Suppliers (All Occupancies). Suppliers of HVAC equipment shall furnish, upon request by prospective purchasers, designers, or contractors, the full and partial capacity and standby input(s) and output(s) of all equipment and components of applied systems, based on equipment in new condition, to enable determination of their compliance with these standards. This includes performance data under modes of operation and ambient conditions necessary to make the analysis outlined in these standards.

Performance data furnished by the equipment supplier or certification under a nationally recognized certification program, when available, satisfies this requirement when all energy input(s), output(s), and operating modes are included.

- (j) Exceptional Designs, Materials, and Devices for Residential Buildings, Except Apartment Houses with Four or More Habitable Stories and Hotels. When designs, materials, or devices are proposed which cannot be adequately modeled by an approved calculation method, an applicant may be granted a building permit upon approval by the Executive Director, based on a determination of energy efficiency using an alternative evaluation technique which demonstrates compliance with the standards.

To obtain approval, the applicant must submit the following materials to the Executive Director:

- (1) A copy of the detailed plans required by Subsection 1403(b).
- (2) A statement explaining why meeting the energy budget requirements cannot be demonstrated using an approved calculation method.
- (3) A letter from the enforcement agency stating that the energy budget requirements cannot be determined using an approved calculation method.
- (4) A detailed evaluation of the energy efficiency of the building's design, materials, or devices using an alternative evaluation technique.
- (5) Any additional materials requested by the Executive Director to evaluate the energy efficiency.

When the materials described above have been properly submitted, the Executive Director shall notify the applicant in writing that his application is complete. The Executive Director shall notify the applicant in writing of his determination within 45 days of the date of notification. If a determination is not made within 45 days, the enforcement agency may issue a building permit. The Executive Director may charge a fee for the review and approval of the application. The Executive Director may delegate the approval of exceptional designs, materials, and devices to a local enforcement agency.

- (k) Other Documentation Requirements for Nonresidential Buildings. Other documentation requirements are contained in Title 24, Part 2, Chapter 53, Sections 2-5313 and 2-5315.

NOTE: Authority cited: Public Resources Code, Sections 25402 and 25402.1

Reference: Public Resources Code, Sections 25402 and 25402.1

Section 1404. Permit Requirements for Additions, Alterations, and Repairs (All Occupancies).

- (a) General. The application of energy building regulations to additions, alterations, and repairs is described in Title 24, Part 2, Chapter 2-53.
- (b) Insulation Certificate. Insulating material shall not be installed by a contractor unless he has certified to the customer, in writing, that the installation meets the applicable requirements of Article 3.

On completion of the installation, the contractor shall post in a conspicuous location a signed certificate declaring that the insulation has been installed in conformance with the provisions of Article 3. The certificate shall state the manufacturer's name and material identification, the R-value of the newly installed insulation, the estimated R-value of

the original insulation, the total R-value, and (in application of loose fill insulation) the minimum contractor installed weight per square foot. This installed weight per square foot shall conform with the manufacturer's installed design density per square foot at the manufacturer's labeled R-value.

NOTE: Authority cited: Public Resources Code, Section 25402
Reference: Public Resources Code, Section 25402

Section 1405. Enforcement by the Commission (All Occupancies).

- (a) Where There Is No Local Enforcement Agency. The Executive Director shall review plans and specifications for proposed buildings in areas where there is no local enforcement agency and for all proposed governmental agency buildings and certify in writing that the buildings conform to the requirements of Title 24, Part 2, Chapter 2-53.
- (b) Where the Local Enforcement Agency Fails to Enforce. If a local enforcement agency fails to enforce the requirements of this article or of Title 24, Part 2, Chapter 2-53, the Commission, after furnishing 10 days written notice, may condition building permit issuance on the Executive Director's review of all plans and his written certification that specifications for proposed new buildings conform to the requirements of Title 24, Part 2, Chapter 2-53.

NOTE: Authority cited: Public Resources Code, Section 25402.1
Reference: Public Resources Code, Section 25402.1

Section 1406. Locally Adopted Energy Standards (All Occupancies).

- (a) Requirements. Local governmental agencies may adopt and enforce energy standards for new buildings, provided the Commission finds that the standards will require the diminution of energy consumption levels permitted by the provisions of Title 24, Part 2, Chapter 2-53, currently in effect. Such actions include adopting the requirements of Chapter 2-53 prior to its effective date, requiring additional energy conservation measures, or setting more stringent energy budgets.
- (b) Documentation. Local governmental agencies wishing to enforce locally adopted energy conservation standards shall submit four copies of the following documents to the Commission:
 - (1) The proposed local energy standards.
 - (2) A study and supporting materials showing how the local agency determined energy savings.

- (3) A statement that the local standards will result in the reduction of energy consumption to or below the levels permitted by the requirements of Title 24, Part 2, Chapter 2-53.
- (4) The basis of the agency's determination that the standards are cost effective.

The Commission or its designee may request additional information if needed for a complete staff analysis of the proposed standard.

- (c) Staff Recommendations. The Executive Director shall distribute copies of the material to the Commissioners, the Public Adviser, and all persons who have requested in writing a copy of the materials.

The Executive Director shall analyze the submitted material. No later than 60 days after submission of the materials, the Executive Director shall submit a written report which contains a recommendation and the basis of such recommendation to the Commission which shall be considered at the next regularly scheduled Commission business meeting. At least 10 days notice shall be given to the local agency.

The Executive Director shall notify the local agency of the number assigned to the filing, the Executive Director's written recommendation, the date, time, and place at which the filing will be considered by the Commission, and the general procedures of the Commission concerning hearings. Notice shall also be sent to any person who requested notice in writing.

- (d) Hearing. All interested persons may present comments on the Executive Director's recommendation at the hearing, subject to the presiding member's discretion, to limit statements to relevant issues and assure an orderly proceeding. Notice of the Commission's decision shall be sent to the local agency and to any person who has requested such notice in writing.

NOTE: Authority cited: Public Resources Code, Section 25402.1
Reference: Public Resources Code, Section 25402.1

Section 1407. Interpretations (All Occupancies).

The Executive Director may make a determination as to the application or interpretation of any provision of this article or of Title 24, Part 2, Chapter 2-53, to any person requesting such a determination. The Executive Director's interpretation shall be placed on the consent calendar for Commission approval. Those interpretations which have wide application or interest shall be broadly publicized.

NOTE: Authority cited: Public Resources Code, Section 25402.1
Reference: Public Resources Code, Section 25402.1

Section 1408. Claims of Exemptions (All Occupancies).

(a) Requirements. Any person may claim exemption from the provisions of any building standard provided he can show that:

- (1) Actual site preparation and construction had not begun before the date the claim for exemption was filed.
- (2) Substantial funds had been expended in good faith on planning, designing, architecture, or engineering before the adoption date of the building standard.
- (3) Compliance with the requirements of the building standard would be impossible without both substantial delays and substantial increase in cost of construction.

The claimant has the burden of proof in establishing the claim.

(b) Documentation. The claim shall be submitted to the Executive Director and shall include:

- (1) The completed signed claim (on a form provided by the Executive Director);
- (2) Contracts entered into by the claimant pertaining to the project;
- (3) Internal financial reports relative to the project accounts;
- (4) Dated schedules of design activities;
- (5) A progress report on project completion; and
- (6) Any additional evidence to support the claim.

The Executive Director may require additional information if needed for a complete staff analysis of the claim.

(c) Staff Recommendations. No later than 60 days after the receipt of a claim and all required documentation, the Executive Director shall submit a recommendation to the Commission which shall be considered at its next regularly scheduled business meeting. At least 10 days notice shall be given to the claimant and to any other person who requests such notice.

The Executive Director shall notify the claimant of the number assigned to the filing, the Executive Director's written recommendation, the date, time, and place at which the claim will be considered by the Commission, and the Commission's general procedures for hearings and actions on claims.

- (d) Hearing. Claims shall be placed on the consent calendar for consideration by the Commission. The business meeting agenda need specify only that claims for exemption from provisions of the building standard will be considered. Notice of specific claims need be sent only to the claimant, the Commissioners, the Public Adviser, and those persons who have requested in writing such notice.

Upon the request of any interested person, a claim may be removed from the consent calendar and considered as a separate item of business.

The Commission shall approve or disapprove the claim in whole or in part and shall provide a statement of reasons supporting the decision. Unless otherwise decided by the Commission, the Executive Director's report shall be deemed adopted as the statement of reasons supporting the decision. The Commission's decision shall be final. Notice of the decision shall be sent to the claimant and to any person who has requested such notice.

NOTE: Authority cited: Public Resources Code, Section 25402.1
Reference: Public Resources Code, Section 25402.1

Section 1409. Approved Calculation Methods.

- (a) Public Domain Computer Program (All Occupancies). By the effective date of this article the Executive Director shall provide at least one public domain computer program which may be used to demonstrate that proposed building designs meet the energy budget requirements of Title 24, Part 2, Chapter 2-53.

For each public domain computer program, the Executive Director shall provide instructions for using the program to demonstrate that the energy budget requirements are met. These instructions shall include a statement of those input values that are set by the Executive Director and those input values which may be varied by the building designer to model energy saving options.

- (b) Simplified Calculation Method (Residential Occupancies). By the effective date of this article the Executive Director shall provide one or more simplified calculation methods, at least one of which shall be a point system, which may be used as an alternative to the public domain computer programs to demonstrate that proposed building designs meet the requirements of Title 24, Part 2, Chapter 2-53. The use of the simplified calculation method(s) shall result in energy-saving requirements which are consistent with those in Title 24, Part 2, Chapter 2-53.
- (c) Certification of Alternative Calculation Methods (All Occupancies). The Executive Director shall certify alternative calculation methods which

may be used to demonstrate that proposed building designs meet the requirements of Title 24, Part 2, Chapter 2-53. Any person may apply for certification of an alternative calculation method. The applicant shall provide documentation to the Executive Director that demonstrates that the alternative calculation method:

- (1) Differentiates the estimated energy-savings results among alternative options substantially similar to the public domain computer program;
- (2) Shows that no changes are made in any of the variables fixed by the Executive Director;
- (3) Provides input and output documentation in a format specified by the Executive Director which facilitates the enforcement agency's review;
- (4) Is supported by clear and concise instructions for using the alternative to demonstrate that the requirements of Title 24, Part 2, Chapter 53, are met; and
- (5) Establishes energy budgets for that alternative calculation method by modeling the buildings used to develop the energy budgets in Title 24, Part 2, Chapter 2-53.

The Executive Director shall provide instructions to the applicant upon request which specify the certification requirements. When the applicant properly submits all required documentation, the Executive Director shall notify the applicant in writing. The Executive Director shall notify the applicant of his or her determination within 90 days of the date of notification of proper documentation.

- (d) Certification of Alternative Component Packages (Residential Occupancies). The Executive Director may certify any alternative component package which he determines will meet the energy budgets specified in Title 24, Part 2, Chapter 2-53, Section 2-5342(a), and is likely to apply to a significant percentage of new residential buildings or to a significant segment of the building construction and design community.
- (e) Publication of Commission Determinations (All Occupancies). The Executive Director shall periodically publish a manual, newsletter, or other administrative guide containing determinations made by the Executive Director and Commission pursuant to this section.

NOTE: Authority cited: Public Resources Code, Section 25402
Reference: Public Resources Code, Section 25402

Section 1410. Appeal to Commission (All Occupancies).

Any person aggrieved by any determination made by the Executive Director pursuant to this article or Title 24, Part 2, Chapter 2-53, may appeal such determination to the California Energy Commission.

NOTE: Authority cited: Public Resources Code, Section 25402
Reference: Public Resources Code, Section 25402

CALIFORNIA ADMINISTRATIVE CODE

**Title 24
(State Building Standards Code)**

**Part 2
(State Building Code)**

**Chapter 2-53
(Energy Conservation in New Building Construction)**

TABLE OF CONTENTS

ENERGY CONSERVATION STANDARDS - PROVISIONS
APPLICABLE TO ALL OCCUPANCIES

<u>Section</u>	<u>Title</u>	<u>Page</u>
2-5301	Scope	2-5
(a)	General	2-5
(b)	Mixed Occupancy	2-6
(c)	Additions, Alterations, and Repairs	2-6
(d)	Construction by Governmental Agencies	2-7
(e)	Administrative Requirements	2-7
2-5302	Definitions	2-8
2-5303	Installation of Certified Insulating Material	2-17
2-5304	Installation of Urea Formaldehyde Foam Field Applied	2-18
2-5305	Installation of Additional Insulation	2-18
2-5306	Heating, Ventilating, And Air Conditioning Equipment	2-20
(a)	Electrically Operated Cooling Equipment	2-20
(b)	Heat Operated Cooling Equipment	2-22
(c)	Combustion Type Heating Equipment	2-23
(d)	Heat Pumps--Heating Mode	2-25
2-5307	Water Heating Equipment	2-26
(a)	Equipment Efficiency	2-26
(b)	Showerheads and Faucets	2-26
(c)	Solar Water Heaters in State-Owned Buildings	2-26

ENERGY CONSERVATION STANDARDS FOR NEW BUILDINGS OF
 OCCUPANCY R (RESIDENTIAL BUILDINGS) EXCEPT APARTMENT
 HOUSES WITH FOUR OR MORE HABITABLE STORIES AND HOTELS

2-5351	Energy Performance Standards	2-28
(a)	Energy Budgets	2-28
(b)	Calculation of Energy Consumption	2-28
(c)	Alternative Component Packages	2-32
2-5352	Mandatory Features and Devices	2-52
(a)	Ceiling Insulation	2-52
(b)	Loose Fill Insulation	2-52
(c)	Wall Insulation	2-52
(d)	Infiltration Control	2-53
(e)	Vapor Barriers	2-54
(f)	Ducts	2-54
(g)	Space Conditioning Equipment Sizing	2-54
(h)	Setback Thermostats	2-55
(i)	Water Heating System Insulation	2-55
(j)	Pipe Insulation	2-55
(k)	Swimming Pool Heating	2-56
(l)	Gas Cooking Appliances	2-57
(m)	Lighting	2-57

CHAPTER 2-53. ENERGY CONSERVATION IN NEW BUILDING CONSTRUCTION

NOTE: Chapter 53 of the U.B.C. is not adopted by reference. The provisions of this chapter represent an entire new Chapter 2-53.

Adoption Table No. 2-53A

Code Section	BSC	HCD 1	HCD 2	SFM	OSA SSS	OSA HC	OSH PD	DHS	OSHA	CEC
Entire Chapter 2-53	-	-	-	-	-	-	-	-	-	X ³

- NOTES:
1. See Sections 2-105 and 2-106 for explanation of this Table.
 2. See State Building Code History Note Appendix.
 3. The building standards contained in this Chapter become effective upon publication.

- EXCEPTIONS:
1. Until June 30, 1982,* Sections 2-5361 through 2-5365 apply to all new buildings of Occupancy R.
 2. Effective July 1, 1982, Sections 2-5351 and 2-5352 apply to new buildings of Occupancy R except apartment houses with four or more habitable stories and hotels, and Sections 2-5361 through 2-5365 apply to new apartment houses with four or more stories and hotels.
 3. Section 2-5305 becomes effective on March 25, 1982.

NOTE: Authority cited: Public Resources Code, Section 25402
Reference: Public Resources Code, Section 25402

*These dates are based on the auxiliary implementation documents being available to the public on or before January 1, 1982. If the auxiliary documents are not available to the public on January 1, 1982, these dates will change to be six months after such documents are available to the public.

ENERGY CONSERVATION STANDARDS--PROVISIONS APPLICABLE TO ALL OCCUPANCIES*

2-5301. Scope.

NOTE: See Table 2-53A, Note 3, for the effective dates of building standards contained in this chapter.

(a) General

1. All Buildings. The provisions of Sections 2-5303 and 2-5304 apply to new and existing buildings at all occupancies.
2. New Buildings. The provisions of this chapter apply to new buildings of occupancies A, B, E, H, and/or R, which 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 this chapter with the exceptions listed in 4.
3. It also applies to heated or mechanically cooled new buildings of occupancies A, B, E, H, and/or R constructed by a governmental agency, whether or not a building permit is needed.
 - a. The provisions of Sections 2-5306 and 2-5307 apply to new buildings of occupancies A, B, E, H, and R.
 - b. The provisions of Sections 2-5311 through 2-5344 apply to new buildings of occupancies A, B, E, and H.
 - c. The provisions of Sections 2-5361 through 2-5365 apply to all new buildings of occupancy R.

EXCEPTION: Effective July 1, 1982 the provisions of Section 2-5361 through 2-5365 apply only to new apartment houses with four or more applicable stories and to hotels.
 - d. The provisions of Sections 2-5351 and 2-5352 apply to all buildings of occupancy R, except apartment houses with four or more stories and to hotels.
3. Existing Buildings. The provisions of Section 2-5305(b), (c) and (d) apply to existing buildings of all occupancies. The provisions of Section 2-5305(a) apply only to existing buildings of occupancy R.

*See Section 2-5301(a) for details of application.

4. The following are not subject to the provisions of this chapter:
- A. The reconstruction and restoration of historical buildings;
and
 - B. Buildings, in which no energy for space heating, space cooling,
or water heating is obtained from depletable sources.
- (b) Mixed Occupancy. When a new building contains both residential occupancy (R) and nonresidential occupancies (A, B, E, and/or H), the residential portion of the building shall comply with the provisions for residential buildings, and the nonresidential portion of the building shall comply with the provisions for nonresidential buildings with the following exceptions:
- (1) The entire new building may be treated, for the purpose of this chapter, as a nonresidential building if the residential portion of the building is both less than 1,000 square feet and less than 30 percent of the conditioned floor area of the building.
 - (2) The entire new building may be treated, for the purpose of this chapter, as a residential building if the nonresidential portion of the building is both less than 1,000 square feet and less than 30 percent of the conditioned floor area of the building.
- (c) Additions, Alterations, and Repairs.
- 1. Occupancies A, B, E and H (Nonresidential Buildings).

NOTE: See Section 2-5312 for the extent of compliance required.
 - 2. Occupancy R (Residential Buildings).

NOTE: See Section 2-5361 for the extent of compliance required.
 - 3. Effective July 1, 1982, additions to existing buildings of occupancy R other than apartment buildings with four or more stories or hotels which increase the conditioned space shall be subject to the ceiling insulation, wall insulation, floor insulation, glazing U value, and shading requirements of Package A for the appropriate climate zone in Tables 2-53U1 through 2-53U16 in Section 2-5351(c), and all the requirements for Sections 2-5351(b) Loose Fill Insulation, 2-5352(c) Wall Insulation, 2-5352(d) Infiltration Control, 2-5352(e) Vapor Barriers, 2-5304(f) Ducts, and 2-5304(j) Lighting and shall have a maximum total glazing area of 16 percent of the conditioned floor area plus the glazing area that was removed from the existing building because of the addition. Alternatively, additions may meet

the energy budgets in Section 2-5351(a) for the appropriate climate zone and building type. New space heating and cooling equipment installed in conjunction with an addition shall meet the requirements of 2-5352(g) Space Conditioning Equipment Sizing, 2-5352(h) Setback Thermostats, and 2-5306 Heating, Ventilation, and Air Conditioning Equipment. New water heating equipment installed in conjunction with an addition shall meet the requirements of 2-5352(i) Water Heating System Insulation and 2-5307 Water Heating Equipment.

- (d) Construction by Governmental Agencies. No governmental agency shall begin construction of any new building unless the building is designed to comply with the requirements of this chapter, and of Title 20, Chapter 2, Subchapter 4, Article 1.
- (e) 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 Title 20, Chapter 2, Subchapter 4, Article 1.

NOTE: Authority cited: Public Resources Code, Sections 25402 and 25402.1
Reference: Public Resources Code, Sections 25402 and 25402.1

2-5302. Definitions. For the purpose of this chapter the following definitions shall apply:

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

ADDITION is an extension or increase in floor area or height of a building or structure.

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

ALTERATION is any change, addition or modification in construction or occupancy.

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.

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

ASTM is the American Society for Testing and Materials.

AUTOMATIC is self-acting, operating by its own mechanism when actuated by some impersonal influence, as for example, a change in current strength, pressure, temperature, or mechanical configuration.

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

BUILDING ENVELOPE is the elements of a building which enclose conditioned spaces and through which thermal energy may be transferred to or from the exterior.

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 conditioned space on all floors, including basements, intermediate floor tiers, and penthouses, measured from the exterior faces of exterior walls and the exterior face of walls separating conditioned and unconditioned spaces. Conditioned floor area does not include covered walkways, open roofed-over areas, porches, pipe trenches, exterior terraces or steps, chimneys, roof overhangs, parking garages, unheated basements, and closets for central gas forced air furnaces.

CONDITIONED SPACE is the space within a building which is provided with a heat supply or a method of cooling, either of which has a connected output capacity in excess of 10 Btu/hr per square foot.

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 Table 2-53B. For those localities not listed in Table 2-53B 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.

EAST-FACING is oriented to within 67 1/2 degrees of true east.

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

ENERGY CONSERVATION DESIGN MANUAL is a manual developed by the California Energy Commission to aid designers, builders and contractors in meeting energy conservation standards.

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.

EXTERIOR WALL AREA is the gross area of wall surface adjacent to heated or cooled spaces, including glazing and doors, exposed to ambient climatic temperatures, measured for a dwelling unit or group of units served by a climate control system.

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.

GROSS FLOOR AREA is the floor area of space on all floors including basements, intermediate floor tiers, and penthouses, measured from the exterior faces of exterior walls. GROSS FLOOR AREA does not include covered walkways, open roofed over areas, porches, pipe trenches, exterior terraces or steps, chimneys, roof overhangs, parking garages and unheated basements.

HABITABLE STORY is a story which contains habitable space.

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

HISTORICAL BUILDING is a building that has been designated by official government action as having historical or architectural significance.

HVAC 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.

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

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.

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 type A, B, E, and/or H.

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

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

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 application of cooling as a secondary process to either pre-conditioned primary air or recirculated room air.

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

REHEAT is the application of heat as a secondary process to either preconditioned primary air or recirculated room air.

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

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 or commercial purposes other than comfort heating.

SHADING, is external protection from direct solar radiation by use of devices permanently affixed to the structure or by an adjacent building.

NOTE: Effective July 1, 1981, SHADING, as applied to buildings of occupancy R other than apartment houses with four or more stories and hotels, is protection from direct solar radiation by use 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 22-1/2 degrees of true south.

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

SYSTEM is a combination of equipment and/or controls, accessories, inter-connecting 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 $\frac{\text{hr-ft}^2\text{-}^\circ\text{F.}}{\text{Btu}}$.

TINTED GLAZING is glazing material which is permanently tinted or permanently surface coated by the manufacturer and provides a maximum shading coefficient as hereinafter specified.

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 $\frac{\text{Btu}}{\text{hr-ft}^2\text{-}^\circ\text{F}}$

VALUE, as used in Section 2-5312, is the estimated cost to replace the building in kind, based on current replacement costs.

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 within a designated space.

WEST-FACING is oriented to within 67-1/2 degrees of true west.

ZONE is a space or group of spaces within a building combined for common control of heating or cooling.

NOTE: Authority cited: Public Resources Code, Sections 25402, 25922.
Reference: Public Resources Code, Sections 25402, 25922.

TABLE 2-53R. ANNUAL HEATING DEGREE DAYS

<u>Location</u>	<u>Annual Heating Degree Days</u>	<u>Location</u>	<u>Annual Heating Degree Days</u>
Alameda Naval Air Station	2,900	Castroville	2,900
Alderpoint	3,290	Central Valley	3,010
Alpine	2,104	Ceres	2,750
Alturas	6,785	Chico	2,795
Anaheim	1,490	China Lake	2,570
Antioch	2,627	Chowchilla	2,400
Arcata	4,800	Chula Vista	2,229
Auburn	3,047	Claremont	1,600
Bakersfield	2,122	Cloverdale	2,666
Barrett Dam	2,363	Clovis	2,600
Barstow	2,496	Colfax	3,441
Beale Air Force Base	2,400	Colusa	2,788
Beaumont	2,790	Concord	2,766
Benicia	2,600	Corning	2,790
Berkeley	2,850	Corona	1,875
Bishop	4,275	Corte Madera	2,600
Blythe Airport	1,076	Crescent City	4,545
Bolinas	2,800	Culver City	1,711
Bonita	1,897	Cuyamaca	4,649
Borrego Springs	1,262	Daggett Airport	2,203
Brawley	1,161	Daly City	3,100
Brisbane	3,060	Danville	2,700
Burbank Airport	1,800	Davis	2,819
Burlingame	2,650	Death Valley	1,205
Burney	6,249	Deep Springs College	4,300
Buttonwillow	2,010	Delano	2,220
Cabrillo National Monument	1,653	Dixon	2,800
Calaveras Big Trees	5,736	Dunsmuir	5,300
Calabasas	1,800	Edwards Air Force Base	3,123
Campo	3,247	El Cajon	1,920
Capitola	2,900	El Capitan Dam	1,397
Carmel	2,900	El Centro	1,216
Carmichael	2,800	Elk Valley	5,404
Carpinteria	2,290	Elsinore	2,101
Castle Air Force Base	2,550	Encinitas	1,952

<u>Location</u>	<u>Annual Heating Degree Days</u>	<u>Location</u>	<u>Annual Heating Degree Days</u>
Escondido	2,052	Jackson	2,760
Eureka	4,679	Julian Wynola	4,085
Fairfield	2,434	King City	2,655
Fairmont	3,327	Lafayette	2,700
Fair Oaks	2 900	Laguna Beach	2,262
Fillmore	2,377	La Jolla	1,750
Folsom	2,899	Lake Arrowhead	5,200
Fort Bidwell	6,365	Lakeport	3,716
Fort Bragg	4,424	Lakewood	1,800
Fort Jones	5,614	La Mesa	1,492
Fortuna	4,700	Lancaster	3,100
Fremont	2,906	Laytonville	4,160
Fresno	2,611	Lemoore	2,960
Galt	2,780	Lincoln	2,890
Garberville	3,510	Lindsay	2,619
Gardena	1,700	Live Oak	2,370
Gilroy	2,808	Livermore	2,781
Grass Valley	4,400	Lodi	2,785
Gridley	2,600	Lompoc	2,900
Gustine	2,360	Long Beach Airport	1,803
Half Moon Bay	2,700	Los Angeles Airport	2,061
Hamilton Air Force Base	2,600	Los Banos	2,267
Hanford	2,642	Los Gatos	2,794
Hawthorne	1,800	McCloud	6,007
Hayward	2,850	Madera	2,485
Healdsburg	2,700	Manteca	2,600
Henshaw Dam	3,652	Maricopa	2,165
Hetch Hetchy	4,797	Mariposa	3,116
Hillsdale	2,650	Markleeville	7,884
Hollister	2,725	Martinez	2,650
Huntington Beach	2,361	Marysville	2,377
Imperial Airport	1,060	Mecca	1,117
Independence	2,995	Mendota	2,555
Inyokern	2,570	Merced	2,697
Ione	2,728	Mineral	7,192

<u>Location</u>	<u>Annual Heating Degree Days</u>	<u>Location</u>	<u>Annual Heating Degree Days</u>
Mitchell Cavern	2,510	Porterville	2,563
Modesto	2,767	Portola	7,055
Moffett Naval Air Station	2,800	Quincy	5,852
Mojave	2,590	Ramona Spaulding	2,223
Monterey	2,985	Red Bluff	2,688
Morro Bay	1,600	Redding	2,610
Mount Shasta	5,800	Redlands	2,052
Napa	2,690	Redwood City	2,596
Needles Airport	1,072	Richmond	2,644
Nellie	4,745	Ripon	2,700
Nevada City	4,488	Riverside	2,089
Newport Beach	2,350	Roseville	2,899
Novato	2,815	Sacramento Executive Airport	2,782
Oakdale	2,832	St. Helena	2,833
Oak Grove	3,516	Salinas	2,959
Oakland	2,906	San Bernardino	2,018
Oceanside	2,092	San Clemente	1,877
Orland	2,830	San Diego	1,439
Oroville	2,597	San Fernando	1,800
Oxnard	2,352	San Francisco Airport	3,080
Palmdale Airport	3,088	San Jacinto	2,376
Palm Springs	1,232	San Jose	2,656
Palo Alto	2,869	San Juan Capistrano	1,646
Palomar, Mt. Observatory	3,868	San Luis Obispo	2,582
Paradise	4,010	San Mateo	2,655
Pasadena	1,694	San Rafael	2,619
Paso Robles Airport	2,890	Santa Ana	1,496
Patterson	2,368	Santa Barbara	2,290
Perris	2,100	Santa Clara	2,566
Petaluma	2,966	Santa Cruz	2,900
Pismo Beach	2,800	Santa Maria	2,985
Pittsburg	2,633	Santa Paula	2,400
Placerville	4,161	Santa Rosa	2,980
Point Loma	1,860	Scotia	3,954
Pomona	2,166	Sierraville	6,953

<u>Location</u>	<u>Annual Heating Degree Days</u>
Sonora	3,086
South San Francisco	3,061
South San Gabriel	1,600
Squaw Valley	8,200
Stockton	2,690
Stony Gorge Reservoir	3,124
Susanville	6,248
Tahoe City	8,162
Tahoe Valley	8,198
Thousand Oaks	2,425
Tracy	2,616
Truckee	8,208
Twentynine Palms	2,006
Ukiah	3,030
Vacaville	2,812
Vallejo	2,598
Vincent	3,510
Visalia	2,526
Vista	2,546
Warner Springs	3,470
Weaverville	4,935
Weed	5,870
Willits	4,160
Willows	2,807
Woodland	2,447
Yosemite	4,800
Yreka	5,393
Yuba City	2,386

2-5303. Installation of Certified Insulating Material. Insulating material of the types listed in Table 2-53C shall not be installed in any building unless it has been certified by the manufacturer, to comply with the California Quality Standards for Insulating material. See Appendix 2-53A for availability of directories of certified insulating material.

TABLE 2-53C. INSULATING MATERIALS SUBJECT TO REGULATION

Type	Form
Aluminum foil	reflective foil
Cellular glass	board form
Cellulose fiber	loose fill and spray applied
Mineral aggregate	board form
Mineral fiber	blankets, board form, loose fill
Perlite	loose fill
Polystyrene	board form, molded, extruded
Polyurethane	board form and field applied
Polyisocyanurate	board form and field applied
Urea formaldehyde foam	field applied
Vermiculite	loose fill

NOTE: See the definition of "Exposed application" in Title 20, Section 1552(e) as it applied to the surface burning characteristics for mineral aggregate and mineral fiber.

NOTE: Authority cited: Public Resources Code, Sections 25920 and 25922.
Reference: Public Resources Code, Sections 25910, 25920, 25921, 25922.

2-5304. Installation of Urea Formaldehyde Foam Field Applied.

- (a) Installation of urea formaldehyde foam insulation is prohibited unless, in addition to the requirements of Section 2-5303, the foam is installed in compliance with the following requirements.
- (b) Exterior Sidewalls, Vapor Barrier. Application is restricted to exterior sidewalls in all buildings. A four mil thickness plastic polyethylene vapor barrier, or equivalent plastic sheeting vapor barrier, shall be installed between the urea formaldehyde foam insulation and the interior space in all applications.

NOTE: Authority cited: Public Resources Code, Sections 25402(a), 25920.
Reference: Public Resources Code, Sections 25920, 25921, 25922.

2-5305. Installation of Additional Insulation. Insulating material shall not be installed by a contractor unless the contractor certified to the customer, in writing, that the insulation meets the requirements of subsections (a), (b), (c), and (d), as applicable.

- (a) This subsection applies only to residential buildings not subject to the requirements of Sections 2-5351, 2-5352, or 2-5361 through 2-5365 (new residential buildings). If insulating material is installed in an accessible attic, the total amount of insulation (after addition of insulation to the amount, if any, already in the attic) shall meet or exceed the higher of the thermal resistance (R-value) determined from Table 2-53D or the R-value recommended by a Residential Conservation Service audit, if one has been performed. Where adequate accessible space is not available, the contractor may install a lesser amount of insulation to fill the area being insulated.
- (b) If external insulation is applied to water heaters and storage and backup tanks for solar water heating systems, it shall have a thermal resistance of at least R-6.
- (c) If insulation is applied to piping in unconditioned space leading to and from water heaters, it shall have a thermal resistance of at least R-3 for the five feet of pipe closest to the water heater, or whatever shorter length is in accessible unconditioned space.
- (d) If external insulation is applied to heating and cooling system ducts, it shall conform to the thermal resistance requirements of Section 1005 of the State Mechanical Code (Title 24, part 4).

TABLE 2-53D. MINIMUM REQUIREMENTS FOR ADDITIONAL ATTIC INSULATION

Degree Days	R-Value ¹
Up to 3000	19
3001 to 4100	20
4101 to 4800	21
4801 to 5500	22
5501 to 6050	23
6051 to 6500	24
6501 to 7000	25
7001 to 7350	26
7351 to 7650	27
7651 to 7900	28
7901 to 8150	29
8151 and up	30

For listing of degree days by locality, see Table 2-53B.

1. The R-values listed refer to the total of in-place insulation and insulation added.

NOTE: Authority cited: Public Resources Code, Section 25922. Reference: Public Resources Code, Section 25922.

2-5306. Heating, Ventilating, and Air Conditioning Equipment.

(a) Electrically Operated Cooling Equipment

- (1) Air conditioners of the types described below shall not be installed unless the manufacturer has lawfully certified to the California Energy Commission compliance with the appliance efficiency standards for that model of air conditioner. See Appendix 2-53A for availability of directories of certified air conditioners.

Room air conditioners (of any capacity), central air conditioning heat pumps (of any capacity) and other central air conditioners with a cooling capacity of less than 65,000 Btu per hour.

Requirements for central air conditioning heat pumps with cooling capacity of 65,000 Btu per hour or more apply to heating performance but not cooling performance.

- (2) The efficiency of all air conditioners whose energy input in the cooling mode is entirely electric, and whose standard rated capacity is equal to or greater than 65,000 Btu/hour shall be not less than the values shown in Tables 2-53E and 2-53F based on one of the test procedures specified in Table 2-53G.

TABLE 2-53E. MINIMUM EFFICIENCY OF ELECTRICALLY DRIVEN COOLING EQUIPMENT, 65,000 Btu/HOUR AND OVER.

Classification in Table 2-53G	Type	Condensing Means	EER	COP
A	Air Conditioners	Any	7.5	
B	Refrigerant Condensing Units	Air		2.5
		Evaporator or Water		3.5

TABLE 2-53F. MINIMUM EFFICIENCY OF ELECTRICALLY
DRIVEN WATER CHILLING PACKAGES

Classification in Table 2-53G	Type	Condensing Means	COP
C	Centrifugal	Air	2.3
		Water	4.0
C	Rotary or Reciprocating	Air	2.2
		Water	3.4

TABLE 2-53G. TEST PROCEDURES FOR ELECTRICALLY
OPERATED AIR COOLING SYSTEMS

Classification	Type	Test Procedure
A	Unitary Air-Conditioning Equipment	ARI 210-81
	Commercial and Industrial Unitary Air-Conditioning Equipment	ARI 360-75
	Air-Source Unitary Heat Pump Equipment	ARI 240-81
	Water-Source Heat Pumps	ARI 320-81
	Commercial and Industrial Unitary Heat Pump Equipment	ARI 340-76
B	Positive Displacement Refrigerant Condensing Units	ARI 520-78
C	Centrifugal or Rotary Water-Chilling Packages	ARI 550-77
	Reciprocating Water-Chilling Packages	ANSI/ARI 590-1976

(b) Heat Operated Cooling Equipment

- (1) The coefficient of performance of heat-operated cooling equipment shall be not less than the values shown in Table 53H when tested at standard rating conditions established in ANSI Standard Z21.40.1 - 1973, ARI Standard 560-75, ASHRAE Standard 22-71 or ASHRAE Standard 24-71 as applicable. These requirements apply to, but are not limited to, absorption equipment, engine-driven equipment, and turbine driven equipment.
- (2) The performance of heat operated (absorption) water chilling equipment shall be based not only on the components included in the unit, but shall include cooling tower fans, pumps, and other parts of the complete system which may be supplied separately. Absorption water chilling units, employing steam or hot water as the energy source, and water cooled absorbers and condensers shall comply with the requirements of ARI Standard 560-75. Direct-fired, absorption water chillers and air conditioners shall comply with ANSI Standard Z21.40.1-73, with Addenda Z21.40.1a - 1974 and the provisions of the Boiler and Fired Pressure Vessel Safety Orders, Title 8, Chapter 4, California Administrative Code.

TABLE 2-53H. MINIMUM EFFICIENCY OF HEAT OPERATED COOLING EQUIPMENT

Heat Source	COP
Direct-Fired (Gas, Oil)	0.48
Indirect-Fired (Steam, Hot Water)	0.68

Performance at Sea Level

$$\text{COP} = \frac{\text{Net cooling output}}{\text{Total heat input (electrical auxiliary inputs excluded)}}$$

(c) Combustion Type Heating Equipment

- (1) Gas-fired comfort heating equipment of the types described below shall not be installed unless the manufacturer has lawfully certified to the California Energy Commission compliance with the appliance efficiency standards for that model of heating equipment. See Appendix 2-53A for availability of directories of certified gas-fired comfort heating equipment.

Gas space heaters excluding the following types:

- o gravity type central furnaces
- o fan type central furnaces with input rates of 400,000 Btu per hour or more
- o infrared heaters

- (2) The appliance efficiency standards include more stringent standards for the following appliances which will become effective on the following dates:

<u>Effective Date</u>	<u>Appliance</u>	<u>Standard</u>
December 22, 1982	Gas fan type central furnaces with input rate less than 175,000 Btu per hour, except those combined with a single package central air conditioner with rated cooling capacity exceeding 65,000 Btu per hour.	71% seasonal efficiency
December 22, 1984	Gas fan type central furnaces with input rate of 175,000 Btu per hour or more and those combined with a single package central air conditioner with rated cooling capacity exceeding 65,000 Btu per hour.	71% seasonal efficiency
December 22, 1981	Fan type wall furnace	80% thermal efficiency 10 watts standby loss (natural gas) 147 watts standby loss (LPG)
December 22, 1983	Unit heaters and duct furnaces	80% thermal efficiency 10 watts standby loss (natural gas) 147 watts standby loss (LPG)

Gas-fired comfort heating equipment of the type described above shall not be installed in a building for which the building permit was issued on or after the applicable effective date shown, unless the manufacturer has lawfully certified to the California Energy Commission compliance with the appliance efficiency standards for that model of heating equipment.

Gas-fired comfort heating equipment of the type described above regardless of the date of manufacture, shall not be installed in a building for which a building permit is issued more than one year after the applicable effective date unless the manufacturer has lawfully certified to the California Energy Commission compliance with the appliance efficiency standards for that model of heating equipment.

- (3) Gas-fired fan type central furnaces or gas-fired fan type wall furnaces (except those designed to burn only liquefied petroleum gases) shall not be installed unless they comply with the intermittent ignition device requirements of the appliance efficiency regulations.

NOTE: Additional requirements related to the efficiency of gas and oil burning heating equipment in buildings with occupancy A, B, E, and H are specified in the Section 2-5337.

(d) Heat Pumps--Heating Mode

- (1) Heat pumps of the types described below shall not be installed unless the manufacturer has lawfully certified to the California Energy Commission compliance with the appliance efficiency standards for that model of heat pump. See Appendix 2-53A for availability of directories of certified heat pumps.

Room air conditioning and central air conditioning heat pumps.

Requirements for central air conditioning heat pumps with cooling capacity of 65,000 Btu per hour or more apply to heating performance but not cooling performance.

- (2) Heat pumps shall be installed with controls to prevent supplementary heater operation when the heating load can be met by the heat pump alone. Supplementary heater operation is permitted during transient periods, such as start-ups, following room thermostat set-point advance, and during defrost.

A two stage room thermostat, which controls the supplementary heat on its second stage, shall be accepted as meeting this requirement. 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. Supplementary heat may be derived from any source of electric resistance heating or combustion heating.

NOTE: Authority cited: Public Resources Code, Section 25402
Reference: Public Resources Code, Section 25402

2-5307. Water Heating Equipment

(a) Equipment Efficiency.

- (1) Water heaters of the type described below shall not be installed unless the manufacturer has lawfully certified to the California Energy Commission compliance with the appliance efficiency standards for that model of water heater. See Appendix 2-53A for availability of directories of certified water heaters.

Water heaters, excluding the following types:

- o nonstorage type electric water heaters
 - o water heaters used exclusively for space heating
- (2) Oil-fired automatic storage heaters shall have a recovery efficiency (E_r) of not less than 75 percent and a standby loss percentage (S) not exceeding

$$S = 2.3 + \frac{67}{CAP}$$

where: CAP = storage capacity in gallons

The method of test of E_r and S shall be as described in Section 2.8 of ANSI Standard Z21.10.3-1981. For oil-fired units, CF = 1.0; Q = total gallons of oil consumed; and H = total heating value of oil in Btu/gallon.

- (b) Showerheads and Faucets. Showerheads, lavatory faucets, and sink faucets shall not be installed unless the manufacturer has lawfully certified to the California Energy Commission compliance with the appliance efficiency standards for that model of showerhead, lavatory faucet, or sink faucet. See Appendix 2-53A for availability of directories of certified showerheads, lavatory faucets and sink faucets.
- (c) Solar Water Heaters in State-Owned Buildings. Construction shall not commence on any state-owned building which has more than 10,000 square feet of floor area and which has a heating, cooling, water heating, or lighting system expected to be used more than 1,000 hours per year, unless the building is equipped with a solar water heating system or has been exempted from this requirement by the State Architect for reasons of economic or physical infeasibility.

NOTE: Authority cited: Public Resources Code, Section 25402
Reference: Public Resources Code, Section 25402

Sections 2-5311 through 2-5344 apply only to nonresidential buildings and are not included in this excerpt. Copies may be obtained by writing to the following address and asking for the Nonresidential Building Standards:

California Energy Commission
Publications Office
1111 Howe Avenue
Sacramento, CA 95825

(916) 920-6216

ENERGY CONSERVATION STANDARDS FOR NEW BUILDINGS OF
OCCUPANCY R (RESIDENTIAL BUILDINGS) EXCEPT APARTMENT
HOUSES WITH FOUR OR MORE HABITABLE STORIES AND HOTELS

2-5351. Energy Performance Standards.

- (a) Energy Budgets. Buildings shall be designed to use no more British thermal units (Btu) of energy from depletable sources than that specified in Tables 2-53R and 2-53S for the appropriate building type and appropriate climate zone shown in Figure 2-53G. The maximum allowable energy use from depletable sources is the sum of the annual space conditioning budget and the annual water heating budget. The annual space conditioning budget is the product of the square feet of conditioned floor area and the total space conditioning budget shown in Table 2-53R.

New buildings shall also meet the requirements of Sections 2-5352 (Mandatory Features and Devices), 2-5306 (Heating, Ventilating, and Air Conditioning Equipment), and 2-5307 (Water Heating Equipment).

- (b) Calculation of Energy Consumption. The application for a building permit shall include documentation which demonstrates, using an approved calculation method, that the new building has been designed to not exceed the allowable energy use in Table 2-53R and 2-53S for the appropriate climate zone. The total calculated annual electricity consumption shall be converted to Btu at the rate of 10,239 Btu per kilowatt-hour, and the total calculated annual natural gas consumption shall be converted to Btu at the rate of 100,000 Btu per therm.

TABLE 2-53R. ANNUAL SPACE CONDITIONING BUDGETS¹

Climate Zone	Multi-Family Buildings								
	Single Family Dwellings and Lodging Houses			With Common Walls but No Common Floor/Ceilings			All Others		
	Heating	Cooling	Total	Heating	Cooling	Total	Heating	Cooling	Total
1	11.1	0.1	11.2	12.2	0	12.2	11.6	0	11.6
2	14.5	8.7	23.2	15.7	5.8	21.5	14.2	5.4	19.6
3	12.3	2.8	15.1	13.7	1.6	15.3	12.8	1.7	14.5
4	9.9	5.7	15.6	11.1	3.9	15.0	10.2	3.6	13.8
5	10.3	3.5	13.8	11.8	2.4	14.2	10.4	2.3	12.7
6	5.2	11.5	16.7	5.7	7.7	13.4	5.0	6.9	11.9
7	2.7	3.9	6.6	3.2	1.8	5.0	2.6	1.7	4.3
8	3.5	13.6	17.1	4.2	8.3	12.5	3.6	6.4	10.0
9	6.9	17.8	24.7	7.4	14.3	21.7	7.9	9.0	16.9
10	5.6	20.9	26.5	6.9	13.9	20.8	6.3	11.1	17.4
11	16.5	22.0	38.5	16.7	14.9	31.6	16.0	11.9	27.9
12	15.8	14.2	30.0	15.0	9.0	24.0	13.9	6.5	20.4
13	12.4	23.0	35.4	11.3	14.9	26.2	10.4	11.3	21.7
14	10.7	27.0	37.7	11.5	19.7	31.2	11.0	16.6	27.6
15	1.4	38.9	40.3	1.8	27.2	29.0	1.5	22.5	24.0
16	20.8	8.9	29.7	19.8	5.9	25.7	18.4	8.2	26.6

1. Thousands of Btu per square foot of conditioned floor space per year.

TABLE 2-53S. ANNUAL WATER HEATING BUDGETS¹

Climate Zone	Multi-Family Buildings		
	Single Family Dwellings and Lodging Houses	With Common Walls but No Common Floor/Ceilings	All Others
1	22,200	22,200	13,000
2	20,800	20,800	12,300
3	20,800	20,800	12,300
4	20,600	20,600	12,300
5	20,600	20,600	12,300
6	19,400	19,400	11,500
7	19,400	19,400	11,500
8	19,400	19,400	11,500
9	19,400	19,400	11,500
10	19,400	19,400	11,500
11	20,400	20,400	12,200
12	20,600	20,600	12,300
13	20,400	20,400	12,200
14	20,900	20,900	12,300
15	18,700	18,700	11,400
16	22,900	22,900	13,100

1. Thousands of Btu per dwelling unit per year.

(c) Alternative Component Packages. The energy budget requirements of 2-5351(a) may be met by installing one of the alternative packages of components shown in Tables 2-53U1 through 2-53U16 for the appropriate climate zone shown in Figure 2-53G. Installed components shall meet the following requirements.

(1) Insulation.

- (A) Insulation shall be installed which has equal or higher R-values than that shown in Tables 2-53U1 through 2-53U16. The minimum ceiling, wall (including heated basements and crawlspaces), and raised floor R-values shown are for insulation installed between framing members. Insulation in other wall systems may meet equivalent minimum R-values that consider the effects of all elements of the wall system.
- (B) Raised floor insulation may be omitted if the foundation walls are insulated to meet the wall insulation minimums shown in Tables 2-53U1 through 2-53U16, a vapor barrier is placed over the entire floor of the crawlspace, and the vents are fitted with operable louvers.
- (C) The minimum depth of concrete-slab floor perimeter insulation shall be 16 inches or the depth of the footing of the building, whichever is greater.

(2) Glazing.

- (A) Glazing shall be installed which has equal or lower U-values than that shown in Tables 2-53U1 through 2-53U16. The types of glazing which meet the maximum U-value requirements are shown in the winter column in Table 8 on page 23.28 of the 1981 ASHRAE Handbook of Fundamentals, without adjustment for the effects of the glazing framing.
- (B) Total glazing area shall not exceed the percentage of conditioned floor area specified in Tables 2-53U1 through 2-53U16.
- (C) South facing glazing area shall not be less than the percentage of conditioned floor area in Tables 2-53U1 through 2-53U16. South facing glazing includes glazing in ceilings which is horizontal or tilted to the south. East and west facing glazing includes glazing in ceilings which is tilted to the east and west, respectively.

(3) Shading.

(A) Shading of south facing glazing required in Tables 2-53U1 through 2-53U16 shall be installed so that the south facing glazing is fully shaded at solar noon on August 21 and fully exposed to direct sunlight at solar noon on December 21. South shading requirements may be met by an optimally designed overhang if one is listed in Tables 2-53U1 through 2-53U16 or a movable shading device described in (C) below.

(B) Shading of west facing glazing required in Tables 2-53U1 through 2-53U16 shall be installed so that the west facing glazing is fully shaded at 5:00 p.m. (solar time) on August 21 and fully exposed to direct sunlight at 3:00 p.m. (solar time) on December 21. Shading requirements for west facing glazing may be met by a movable shading device described in (C) below.

(C) Movable shading devices include but are not limited to operable louvers, movable external shading devices, and tight-fitting internal shades which meet the shading coefficient requirements in Tables 2-53U1 through 2-53U16.

(4) Thermal Mass. Thermal mass required in Tables 2-53U1 through 2-53U16 shall be installed to meet or exceed the minimum heat capacity and surface area ratio shown in Table 2-53T. Distributed mass in floors, walls, and ceilings which is directly exposed to the conditioned space may be considered in meeting this requirement. Thermal mass includes but is not limited to hard-surfaced slab floors, masonry walls and fireplaces, and gypsum board or plaster in excess of 1/2 inch thickness on ceilings and walls. Thermal mass shall not include carpeted slab floors and heavy weight exterior walls which are installed to meet the alternative wall insulation minimums shown in parentheses in Tables 2-53U1 through 2-53U16.

TABLE 2-53T. MINIMUM THERMAL MASS REQUIREMENTS

<u>Building Type</u>	<u>Surface Area Ratio¹</u>	<u>Minimum Heat Capacity²</u>
Single Family Dwellings and Lodging Houses	7.8	36.5
Multi-family Buildings with Common Walls but with no Common Floor/Ceilings	5.0	23.1
All Other Multi-Family Buildings	4.0	18.4

1. Surface Area Ratio = $\frac{A_{\text{mass}}}{A_{\text{glazing}}}$.

2. Minimum Heat Capacity = $\frac{A_{\text{mass}} \times D \times C \times t}{A_{\text{glazing}}}$.

Where A_{mass} = the surface area of exposed mass, ft²;

D = the density of the mass, lb/ft³;

C = the specific heat of the mass, Btu/lb-°F;

t = the thickness of the mass, ft, up to a maximum thickness of 1/6 foot (2 inches); and

A_{glazing} = the surface area of the south facing glazing, ft².

- (5) Continuous Infiltration Barrier. Continuous infiltration barriers required in Tables 2-53U1 through 2-53U16 shall be installed over the inside face of framing in ceilings and in exterior walls. Where ceilings are plank and beam construction exposed to the conditioned space, the barrier shall be placed on top of the planking, and the wall/ceiling joints shall be sealed with caulking or sealant. All openings in the continuous vapor barrier, including spaces around plumbing, electrical conduits and boxes, gas lines and valves, luminaires, ducts, flues and other elements which penetrate the infiltration barrier, shall be sealed with permanent tape or sealant.

- (6) Electrical Outlet Plate Gaskets. Electrical outlet plate gaskets required in Tables 2-53U1 through 2-53U16 shall be installed on all receptacle, switch or other electrical boxes in exterior and interior walls.
- (7) Heating System Type. Heating system types shall be installed as required in Tables 2-53U1 through 2-53U16. A gas heating system is a natural or liquefied petroleum gas heating system.

In climate zones 1, 3, 5, 6, 7, 15, and 16 shown in Figure 2-53G where natural gas is not available, zonally controlled electric resistance or radiant heating systems may be used. Such systems shall have two or more separately controlled zones in the dwelling unit.

- (8) Air-to-Air Heat Exchanger. The air-to-air heat exchanger required in Tables 2-53U1 through 2-53U16 shall be capable of ventilating the dwelling unit at a rate equal to at least 0.7 times the volume of the conditioned space per hour. An air-to-air heat exchanger is a device which will reduce the heat losses or gains which occur when a building is mechanically ventilated, by transferring heat between the conditioned air being exhausted and the unconditioned air being supplied.

This requirement may be met by a central mechanical ventilation system with an integral air-to-air heat exchanger or by one or more single package room mechanical ventilators with an integral air-to-air heat exchanger.

- (9) Solar Domestic Water Heating System. Solar domestic water heating systems with electric resistance backup heating installed to meet the requirements for Package A or B and solar domestic water heating systems with gas backup heating installed to meet the requirements for Package C in Tables 2-53U1 through 2-53U16 shall be designed so that at least 60 percent of the energy required for domestic water heating is provided by solar energy, excluding storage tank losses, piping heat losses, and pumping energy. Documentation specified by the Executive Director shall be submitted with the building permit application which demonstrates that this requirement is met.

NOTE: Authority cited: Public Resources Code, Section 25402
Reference: Public Resources Code, Section 25402

TABLE 2-53U1. ALTERNATIVE COMPONENT PACKAGES FOR CLIMATE ZONE 1

Component	Package		
	A	B	C
BUILDING ENVELOPE			
Insulation Minimums			
Ceiling	R 30	R 30	R 30
Wall ¹	R 19 (R 8.5)	R 19 (R 5.0)	R 19 (R 5.5)
Slab Floor Perimeter	R 7	R 7	R 7
Raised Floor	R 19	R 19	R 19
Glazing			
Maximum U Value	0.65	0.65	0.65
Maximum Total Area	no requirement	16.0%	14.0%
Maximum Total Nonsouth Facing Area	9.6%	no requirement	no requirement
Minimum South Facing Area	6.4%	no requirement	no requirement
Shading			
South Facing Glazing	not required	not required	not required
West Facing Glazing	not required	not required	not required
Thermal Mass	required	not required	not required
Continuous Infiltration Barrier	not required	required	not required
Electrical Outlet Plate Gaskets	not required	required	not required
SPACE CONDITIONING SYSTEM			
Heating System Type ²	gas	gas	gas
Air-to-Air Heat Exchanger	not required	required	not required
DOMESTIC WATER HEATING SYSTEM TYPE			
	gas, heat pump, or solar with any type of backup heat	gas, heat pump, or solar with any type of backup heat	solar with gas backup heat

1. The value in parentheses is the R-value for the entire wall assembly if the wall weight exceeds 40 pounds per square foot. The insulation must be integral with or installed on the outside of the exterior mass. The inside surface of the thermal mass, including plaster or gypsum board in direct contact with the masonry wall, shall be exposed to the room air. The exterior wall used to meet the R-value in parentheses cannot also be used to meet the above thermal mass requirement.
2. Where natural gas is not available, zonally controlled electric resistance or radiant heating systems may be used.

TABLE 2-53U2. ALTERNATIVE COMPONENT PACKAGES FOR CLIMATE ZONE 2

Component	Package		
	A	B	C
BUILDING ENVELOPE			
Insulation Minimums			
Ceiling	R 30	R 30	R 19
Wall ¹	R 11 (R 2.5)	R 19 (R 2.5)	R 11 (R 2.5)
Slab Floor Perimeter	R 7	R 7	R 7
Raised Floor	R 11	R 19	R 11
Glazing			
Maximum U Value	1.10	0.65	0.65
Maximum Total Area	no requirement	14.0%	16.0%
Maximum Total Nonsouth Facing Area	9.6%	no requirement	no requirement
Minimum South Facing Area	6.4%	no requirement	no requirement
Shading			
South Facing Glazing	not required	not required	not required
West Facing Glazing	not required	not required	not required
Thermal Mass	required	not required	not required
Continuous Infiltration Barrier	not required	not required	not required
Electrical Outlet Plate Gaskets	not required	not required	not required
SPACE CONDITIONING SYSTEM			
Heating System Type	gas or heat pump	gas or heat pump	gas or heat pump
Air-to-Air Heat Exchanger	not required	not required	not required
DOMESTIC WATER HEATING SYSTEM TYPE	gas, heat pump, or solar with any type of backup heat	gas, heat pump, or solar with any type of backup heat	solar with gas backup heat

1. The value in parentheses is the R-value for the entire wall assembly if the wall weight exceeds 40 pounds per square foot. The insulation must be integral with or installed on the outside of the exterior mass. The inside surface of the thermal mass, including plaster or gypsum board in direct contact with the masonry wall, shall be exposed to the room air. The exterior wall used to meet the R-value in parentheses cannot also be used to meet the above thermal mass requirement.

TABLE 2-53U3. ALTERNATIVE COMPONENT PACKAGES FOR CLIMATE ZONE 3

Component	Package		
	A	B	C
BUILDING ENVELOPE			
Insulation Minimums			
Ceiling	R 30	R 30	R 30
Wall ¹	R 11 (R 4.5)	R 19 (R 3.5)	R 11 (R 2.5)
Slab Floor Perimeter	R 7	R 7	R 7
Raised Floor	R 11	R 19	R 11
Glazing			
Maximum U Value	1.10	0.65	1.10
Maximum Total Area	no requirement	16.0%	14.0%
Maximum Total Nonsouth Facing Area	9.6%	no requirement	no requirement
Minimum South Facing Area	6.4%	no requirement	no requirement
Shading			
South Facing Glazing	not required	not required	not required
West Facing Glazing	not required	not required	not required
Thermal Mass	required	not required	not required
Continuous Infiltration Barrier	not required	not required	not required
Electrical Outlet Plate Gaskets	not required	not required	not required
SPACE CONDITIONING SYSTEM			
Heating System Type ²	gas	gas	gas
Air-to-Air Heat Exchanger	not required	not required	not required
DOMESTIC WATER HEATING SYSTEM TYPE	gas, heat pump, or solar with any type of backup heat	gas, heat pump, or solar with any type of backup heat	solar with gas backup heat

1. The value in parentheses is the R-value for the entire wall assembly if the wall weight exceeds 40 pounds per square foot. The insulation must be integral with or installed on the outside of the exterior mass. The inside surface of the thermal mass, including plaster or gypsum board in direct contact with the masonry wall, shall be exposed to the room air. The exterior wall used to meet the R-value in parentheses cannot also be used to meet the above thermal mass requirement.
2. Where natural gas is not available, zonally controlled electric resistance or radiant heating systems may be used.

TABLE 2-53U4. ALTERNATIVE COMPONENT PACKAGES FOR CLIMATE ZONE 4

Component	Package		
	A	B	C
BUILDING ENVELOPE			
Insulation Minimums			
Ceiling	R 30	R 30	R 30
Wall ¹	R 11 (R 3.5)	R 19 (R 3.5)	R 11 (R 3.0)
Slab Floor Perimeter	R 7	R 7	R 7
Raised Floor	R 11	R 19	R 11
Glazing			
Maximum U Value	1.10	0.65	0.65
Maximum Total Area	no requirement	16.0%	14.0%
Maximum Total Nonsouth Facing Area	9.6%	no requirement	no requirement
Minimum South Facing Area	6.4%	no requirement	no requirement
Shading			
South Facing Glazing	not required	not required	not required
West Facing Glazing	not required	not required	not required
Thermal Mass	required	not required	not required
Continuous Infiltration Barrier	not required	not required	not required
Electrical Outlet Plate Gaskets	not required	not required	not required
SPACE CONDITIONING SYSTEM			
Heating System Type	gas or heat pump	gas or heat pump	gas or heat pump
Air-to-Air Heat Exchanger	not required	not required	not required
DOMESTIC WATER HEATING SYSTEM TYPE			
	gas, heat pump, or solar with any type of backup heat	gas, heat pump, or solar with any type of backup heat	solar with gas backup heat

1. The value in parentheses is the R-value for the entire wall assembly if the wall weight exceeds 40 pounds per square foot. The insulation must be integral with or installed on the outside of the exterior mass. The inside surface of the thermal mass, including plaster or gypsum board in direct contact with the masonry wall, shall be exposed to the room air. The exterior wall used to meet the R-value in parentheses cannot also be used to meet the above thermal mass requirement.

TABLE 2-53U5. ALTERNATIVE COMPONENT PACKAGES FOR CLIMATE ZONE 5

Component	Package		
	A	B	C
BUILDING ENVELOPE			
Insulation Minimums			
Ceiling	R 30	R 30	R 19
Wall ¹	R 11 (R 2.5)	R 19 (R 2.5)	R 11 (R 2.5)
Slab Floor Perimeter	R 7	R 7	R 7
Raised Floor	R 11	R 19	R 11
Glazing			
Maximum U Value	1.10	0.65	0.65
Maximum Total Area	no requirement	14.0%	16.0%
Maximum Total Nonsouth Facing Area	9.6%	no requirement	no requirement
Minimum South Facing Area	6.4%	no requirement	no requirement
Shading			
South Facing Glazing	not required	not required	not required
West Facing Glazing	not required	not required	not required
Thermal Mass	required	not required	not required
Continuous Infiltration Barrier	not required	not required	not required
Electrical Outlet Plate Gaskets	not required	not required	not required
SPACE CONDITIONING SYSTEM			
Heating System Type ²	gas	gas	gas
Air-to-Air Heat Exchanger	not required	not required	not required
DOMESTIC WATER HEATING SYSTEM TYPE	gas, heat pump, or solar with any type of backup heat	gas, heat pump, or solar with any type of backup heat	solar with gas backup heat

1. The value in parentheses is the R-value for the entire wall assembly if the wall weight exceeds 40 pounds per square foot. The insulation must be integral with or installed on the outside of the exterior mass. The inside surface of the thermal mass, including plaster or gypsum board in direct contact with the masonry wall, shall be exposed to the room air. The exterior wall used to meet the R-value in parentheses cannot also be used to meet the above thermal mass requirement.
2. Where natural gas is not available, zonally controlled electric resistance or radiant heating systems may be used.

TABLE 2-53U6. ALTERNATIVE COMPONENT PACKAGES FOR CLIMATE ZONE 6

Component	Package		
	A	B	C
BUILDING ENVELOPE			
Insulation Minimums			
Ceiling	R 19	R 30	R 19
Wall ¹	R 11 (R 2.5)	R 19 (R 2.5)	R 11 (R 2.5)
Slab Floor Perimeter	no requirement	R 7	no requirement
Raised Floor	R 11	R 19	R 11
Glazing			
Maximum U Value	1.10	0.65	1.10
Maximum Total Area	no requirement	16.0%	14.0%
Maximum Total Nonsouth Facing Area	9.6%	no requirement	no requirement
Minimum South Facing Area	6.4%	no requirement	no requirement
Shading			
South Facing Glazing	not required	not required	not required
West Facing Glazing	not required	not required	not required
Thermal Mass	required	not required	not required
Continuous Infiltration Barrier	not required	not required	not required
Electrical Outlet Plate Gaskets	not required	not required	not required
SPACE CONDITIONING SYSTEM			
Heating System Type ²	gas or heat pump	gas or heat pump	gas or heat pump
Air-to-Air Heat Exchanger	not required	not required	not required
DOMESTIC WATER HEATING SYSTEM TYPE			
	gas, heat pump, or solar with any type of backup heat	gas, heat pump, or solar with any type of backup heat	solar with gas backup heat

1. The value in parentheses is the R-value for the entire wall assembly if the wall weight exceeds 40 pounds per square foot. The insulation must be integral with or installed on the outside of the exterior mass. The inside surface of the thermal mass, including plaster or gypsum board in direct contact with the masonry wall, shall be exposed to the room air. The exterior wall used to meet the R-value in parentheses cannot also be used to meet the above thermal mass requirement.

TABLE 2-53U7. ALTERNATIVE COMPONENT PACKAGES FOR CLIMATE ZONE 7

Component	Package		
	A	B	C
BUILDING ENVELOPE			
Insulation Minimums			
Ceiling	R 19	R 30	R 19
Wall ¹	R 11 (R 2.5)	R 11 (R 2.5)	R 11 (R 2.5)
Slab Floor Perimeter	no requirement	R 7	no requirement
Raised Floor	R 11	R 11	R 11
Glazing			
Maximum U Value	1.10	0.65	1.10
Maximum Total Area	no requirement	14.0%	14.0%
Maximum Total Nonsouth Facing Area	9.6%	no requirement	no requirement
Minimum South Facing Area	6.4%	no requirement	no requirement
Shading			
South Facing Glazing	not required	not required	not required
West Facing Glazing	not required	not required	not required
Thermal Mass	required	not required	not required
Continuous Infiltration Barrier	not required	not required	not required
Electrical Outlet Plate Gaskets	not required	not required	not required
SPACE CONDITIONING SYSTEM			
Heating System Type ²	gas	gas	gas
Air-to-Air Heat Exchanger	not required	not required	not required
DOMESTIC WATER HEATING SYSTEM TYPE			
	gas, heat pump, or solar with any type of backup heat	gas, heat pump, or solar with any type of backup heat	solar with gas backup heat

1. The value in parentheses is the R-value for the entire wall assembly if the wall weight exceeds 40 pounds per square foot. The insulation must be integral with or installed on the outside of the exterior mass. The inside surface of the thermal mass, including plaster or gypsum board in direct contact with the masonry wall, shall be exposed to the room air. The exterior wall used to meet the R-value in parentheses cannot also be used to meet the above thermal mass requirement.
2. Where natural gas is not available, zonally controlled electric resistance or radiant heating systems may be used.

TABLE 2-53U8. ALTERNATIVE COMPONENT PACKAGES FOR CLIMATE ZONE 8

Component	Package		
	A	B	C
BUILDING ENVELOPE			
Insulation Minimums			
Ceiling	R 30	R 30	R 30
Wall ¹	R 11 (R 2.5)	R 19 (R 2.5)	R 11 (R 2.5)
Slab Floor Perimeter	no requirement	R 7	R 7
Raised Floor	R 11	R 19	R 11
Glazing			
Maximum U Value	1.10	0.65	1.10
Maximum Total Area	no requirement	14.0%	14.0%
Maximum Total Nonsouth Facing Area	9.6%	no requirement	no requirement
Minimum South Facing Area	6.4%	no requirement	no requirement
Shading			
South Facing Glazing	optimum overhang or 0.36 shading coefficient	optimum overhang or 0.36 shading coefficient	optimum overhang or 0.36 shading coefficient
West Facing Glazing	0.36 shading coefficient	0.36 shading coefficient	0.36 shading coefficient
Thermal Mass	required	not required	not required
Continuous Infiltration Barrier	not required	not required	not required
Electrical Outlet Plate Gaskets	not required	not required	not required
SPACE CONDITIONING SYSTEM			
Heating System Type	gas or heat pump	gas or heat pump	gas or heat pump
Air-to-Air Heat Exchanger	not required	not required	not required
DOMESTIC WATER HEATING SYSTEM TYPE	gas, heat pump, or solar with any type of backup heat	gas, heat pump, or solar with any type of backup heat	solar with gas backup heat

1. The value in parentheses is the R-value for the entire wall assembly if the wall weight exceeds 40 pounds per square foot. The insulation must be integral with or installed on the outside of the exterior mass. The inside surface of the thermal mass, including plaster or gypsum board in direct contact with the masonry wall, shall be exposed to the room air. The exterior wall used to meet the R-value in parentheses cannot also be used to meet the above thermal mass requirement.

TABLE 2-53U9. ALTERNATIVE COMPONENT PACKAGES FOR CLIMATE ZONE 9

Component	Package		
	A	B	C
BUILDING ENVELOPE			
Insulation Minimums			
Ceiling	R 30	R 30	R 30
Wall ¹	R 11 (R 2.5)	R 19 (R 2.5)	R 11 (R 2.5)
Slab Floor Perimeter	R 7	R 7	no requirement
Raised Floor	R 11	R 19	R 11
Glazing			
Maximum U Value	1.10	0.65	0.65
Maximum Total Area	no requirement	14.0%	14.0%
Maximum Total Nonsouth Facing Area	9.6%	no requirement	no requirement
Minimum South Facing Area	6.4%	no requirement	no requirement
Shading			
South Facing Glazing	optimum overhang or 0.36 shading coefficient	optimum overhang or 0.36 shading coefficient	optimum overhang or 0.36 shading coefficient
West Facing Glazing	0.36 shading coefficient	0.36 shading coefficient	0.36 shading coefficient
Thermal Mass	required	not required	not required
Continuous Infiltration Barrier	not required	not required	not required
Electrical Outlet Plate Gaskets	not required	not required	not required
SPACE CONDITIONING SYSTEM			
Heating System Type	gas or heat pump	gas or heat pump	gas or heat pump
Air-to-Air Heat Exchanger	not required	not required	not required
DOMESTIC WATER HEATING SYSTEM TYPE			
	gas, heat pump, or solar with any type of backup heat	gas, heat pump, or solar with any type of backup heat	solar with gas backup heat

1. The value in parentheses is the R-value for the entire wall assembly if the wall weight exceeds 40 pounds per square foot. The insulation must be integral with or installed on the outside of the exterior mass. The inside surface of the thermal mass, including plaster or gypsum board in direct contact with the masonry wall, shall be exposed to the room air. The exterior wall used to meet the R-value in parentheses cannot also be used to meet the above thermal mass requirement.

TABLE 2-53U10. ALTERNATIVE COMPONENT PACKAGES FOR CLIMATE ZONE 10

Component	Package		
	A	B	C
BUILDING ENVELOPE			
Insulation Minimums			
Ceiling	R 30	R 30	R 30
Wall ¹	R 11 (R 2.5)	R 19 (R 2.5)	R 11 (R 2.5)
Slab Floor Perimeter	R 7	R 7	R 7
Raised Floor	R 11	R 19	R 11
Glazing			
Maximum U Value	1.10	0.65	0.65
Maximum Total Area	no requirement	16.0%	16.0%
Maximum Total Nonsouth Facing Area	9.6%	no requirement	no requirement
Minimum South Facing Area	6.4%	no requirement	no requirement
Shading			
South Facing Glazing	optimum overhang or 0.36 shading coefficient	optimum overhang or 0.36 shading coefficient	optimum overhang or 0.36 shading coefficient
West Facing Glazing	0.36 shading coefficient	0.36 shading coefficient	0.36 shading coefficient
Thermal Mass	required	not required	not required
Continuous Infiltration Barrier	not required	not required	not required
Electrical Outlet Plate Gaskets	not required	not required	not required
SPACE CONDITIONING SYSTEM			
Heating System Type	gas or heat pump	gas or heat pump	gas or heat pump
Air-to-Air Heat Exchanger	not required	not required	not required
DOMESTIC WATER HEATING SYSTEM TYPE			
	gas, heat pump, or solar with any type of backup heat	gas, heat pump, or solar with any type of backup heat	solar with gas backup heat

1. The value in parentheses is the R-value for the entire wall assembly if the wall weight exceeds 40 pounds per square foot. The insulation must be integral with or installed on the outside of the exterior mass. The inside surface of the thermal mass, including plaster or gypsum board in direct contact with the masonry wall, shall be exposed to the room air. The exterior wall used to meet the R-value in parentheses cannot also be used to meet the above thermal mass requirement.

TABLE 2-53U11. ALTERNATIVE COMPONENT PACKAGES FOR CLIMATE ZONE 11

Component	Package		
	A	B	C
BUILDING ENVELOPE			
Insulation Minimums			
Ceiling	R 30	R 30	R 30
Wall ¹	R 11 (R 5.0)	R 19 (R 5.5)	R 11 (R 4.0)
Slab Floor Perimeter	R 7	R 7	R 7
Raised Floor	R 11	R 19	R 11
Glazing			
Maximum U Value	0.65	0.65	0.65
Maximum Total Area	no requirement	14.0%	16.0%
Maximum Total Nonsouth Facing Area	9.6%	no requirement	no requirement
Minimum South Facing Area	6.4%	no requirement	no requirement
Shading			
South Facing Glazing	optimum overhang or 0.36 shading coefficient	optimum overhang or 0.36 shading coefficient	optimum overhang or 0.36 shading coefficient
West Facing Glazing	0.36 shading coefficient	0.36 shading coefficient	0.36 shading coefficient
Thermal Mass	required	not required	not required
Continuous Infiltration Barrier	not required	not required	not required
Electrical Outlet Plate Gaskets	not required	not required	not required
SPACE CONDITIONING SYSTEM			
Heating System Type	gas or heat pump	gas or heat pump	gas or heat pump
Air-to-Air Heat Exchanger	not required	not required	not required
DOMESTIC WATER HEATING SYSTEM TYPE			
	gas, heat pump, or solar with any type of backup heat	gas, heat pump, or solar with any type of backup heat	solar with gas backup heat

1. The value in parentheses is the R-value for the entire wall assembly if the wall weight exceeds 40 pounds per square foot. The insulation must be integral with or installed on the outside of the exterior mass. The inside surface of the thermal mass, including plaster or gypsum board in direct contact with the masonry wall, shall be exposed to the room air. The exterior wall used to meet the R-value in parentheses cannot also be used to meet the above thermal mass requirement.

TABLE 2-53U12. ALTERNATIVE COMPONENT PACKAGES FOR CLIMATE ZONE 12

Component	Package		
	A	B	C
BUILDING ENVELOPE			
Insulation Minimums			
Ceiling	R 30	R 30	R 30
Wall ¹	R 11 (R 3.5)	R 19 (R 3.5)	R 11 (R 2.5)
Slab Floor Perimeter	no requirement	R 7	R 7
Raised Floor	R 11	R 19	R 11
Glazing			
Maximum U Value	0.65	0.65	0.65
Maximum Total Area	no requirement	14.0%	16.0%
Maximum Total Nonsouth Facing Area	9.6%	no requirement	no requirement
Minimum South Facing Area	6.4%	no requirement	no requirement
Shading			
South Facing Glazing	optimum overhang or 0.36 shading coefficient	optimum overhang or 0.36 shading coefficient	optimum overhang or 0.36 shading coefficient
West Facing Glazing	0.36 shading coefficient	0.36 shading coefficient	0.36 shading coefficient
Thermal Mass	required	not required	not required
Continuous Infiltration Barrier	not required	not required	not required
Electrical Outlet Plate Gaskets	not required	not required	not required
SPACE CONDITIONING SYSTEM			
Heating System Type	gas or heat pump	gas or heat pump	gas or heat pump
Air-to-Air Heat Exchanger	not required	not required	not required
DOMESTIC WATER HEATING SYSTEM TYPE			
	gas, heat pump, or solar with any type of backup heat	gas, heat pump, or solar with any type of backup heat	solar with gas backup heat

1. The value in parentheses is the R-value for the entire wall assembly if the wall weight exceeds 40 pounds per square foot. The insulation must be integral with or installed on the outside of the exterior mass. The inside surface of the thermal mass, including plaster or gypsum board in direct contact with the masonry wall, shall be exposed to the room air. The exterior wall used to meet the R-value in parentheses cannot also be used to meet the above thermal mass requirement.

TABLE 2-53U13. ALTERNATIVE COMPONENT PACKAGES FOR CLIMATE ZONE 13

Component	Package		
	A	B	C
BUILDING ENVELOPE			
Insulation Minimums			
Ceiling	R 30	R 30	R 30
Wall ¹	R 11 (R 4.0)	R 19 (R 4.0)	R 11 (R 3.0)
Slab Floor Perimeter	no requirement	R 7	R 7
Raised Floor	R 11	R 19	R 11
Glazing			
Maximum U Value	0.65	0.65	0.65
Maximum Total Area	no requirement	14.0%	16.0%
Maximum Total Nonsouth Facing Area	9.6%	no requirement	no requirement
Minimum South Facing Area	6.4%	no requirement	no requirement
Shading			
South Facing Glazing	optimum overhang or 0.36 shading coefficient	optimum overhang or 0.36 shading coefficient	optimum overhang or 0.36 shading coefficient
West Facing Glazing	0.36 shading coefficient	0.36 shading coefficient	0.36 shading coefficient
Thermal Mass	required	not required	not required
Continuous Infiltration Barrier	not required	not required	not required
Electrical Outlet Plate Gaskets	not required	not required	not required
SPACE CONDITIONING SYSTEM			
Heating System Type	gas or heat pump	gas or heat pump	gas or heat pump
Air-to Air Heat Exchanger	not required	not required	not required
DOMESTIC WATER HEATING SYSTEM TYPE			
	gas, heat pump, or solar with any type of backup heat	gas, heat pump, or solar with any type of backup heat	solar with gas backup heat

1. The value in parentheses is the R-value for the entire wall assembly if the wall weight exceeds 40 pounds per square foot. The insulation must be integral with or installed on the outside of the exterior mass. The inside surface of the thermal mass, including plaster or gypsum board in direct contact with the masonry wall, shall be exposed to the room air. The exterior wall used to meet the R-value in parentheses cannot also be used to meet the above thermal mass requirement.

TABLE 2-53U14. ALTERNATIVE COMPONENT PACKAGES FOR CLIMATE ZONE 14

Component	Package		
	A	B	C
BUILDING ENVELOPE			
Insulation Minimums			
Ceiling	R 38	R 38	R 30
Wall ¹	R 19 (R 7.0)	R 19 (R 5.5)	R 19 (R 5.5)
Slab Floor Perimeter	R 7	R 7	R 7
Raised Floor	R 19	R 19	R 19
Glazing			
Maximum U Value	0.65	0.65	0.65
Maximum Total Area	no requirement	16.0%	14.0%
Maximum Total Nonsouth Facing Area	9.6%	no requirement	no requirement
Minimum South Facing Area	6.4%	no requirement	no requirement
Shading			
South Facing Glazing	0.15 shading coefficient	0.15 shading coefficient	0.15 shading coefficient
East/West Facing Glazing	0.15 shading coefficient	0.15 shading coefficient	0.15 shading coefficient
Thermal Mass	required	not required	not required
Continuous Infiltration Barrier	not required	required	not required
Electrical Outlet Plate Gaskets	not required	required	not required
SPACE CONDITIONING SYSTEM			
Heating System Type	gas or heat pump	gas or heat pump	gas or heat pump
Air-to-Air Heat Exchanger	not required	required	not required
DOMESTIC WATER HEATING SYSTEM TYPE			
	gas, heat pump, or solar with any type of backup heat	gas, heat pump, or solar with any type of backup heat	solar with gas backup heat

1. The value in parentheses is the R-value for the entire wall assembly if the wall weight exceeds 40 pounds per square foot. The insulation must be integral with or installed on the outside of the exterior mass. The inside surface of the thermal mass, including plaster or gypsum board in direct contact with the masonry wall, shall be exposed to the room air. The exterior wall used to meet the R-value in parentheses cannot also be used to meet the above thermal mass requirement.

TABLE 2-53U15. ALTERNATIVE COMPONENT PACKAGES FOR CLIMATE ZONE 15

Component	Package		
	A	B	C
BUILDING ENVELOPE			
Insulation Minimums			
Ceiling	R 30	R 38	R 30
Wall ¹	R 19 (R 5.5)	R 19 (R 4.5)	R 19 (R 4.0)
Slab Floor Perimeter	R 7	R 7	R 7
Raised Floor	R 19	R 19	R 19
Glazing			
Maximum U Value	0.65	0.65	0.65
Maximum Total Area	no requirement	16.0%	16.0%
Maximum Total Nonsouth Facing Area	9.6%	no requirement	no requirement
Minimum South Facing Area	6.4%	no requirement	no requirement
Shading			
South Facing Glazing	0.15 shading coefficient	0.15 shading coefficient	0.15 shading coefficient
East/West Facing Glazing	0.15 shading coefficient	0.15 shading coefficient	0.15 shading coefficient
Thermal Mass	required	not required	not required
Continuous Infiltration Barrier	not required	required	not required
Electrical Outlet Plate Gaskets	not required	required	not required
SPACE CONDITIONING SYSTEM			
Heating System Type ²	gas	gas	gas
Air-to-Air Heat Exchanger	not required	required	not required
DOMESTIC WATER HEATING SYSTEM TYPE			
	gas, heat pump, or solar with any type of backup heat	gas, heat pump, or solar with any type of backup heat	solar with gas backup heat

1. The value in parentheses is the R-value for the entire wall assembly if the wall weight exceeds 40 pounds per square foot. The insulation must be integral with or installed on the outside of the exterior mass. The inside surface of the thermal mass, including plaster or gypsum board in direct contact with the masonry wall, shall be exposed to the room air. The exterior wall used to meet the R-value in parentheses cannot also be used to meet the above thermal mass requirement.
2. Where natural gas is not available, zonally controlled electric resistance or radiant heating systems may be used.

TABLE 2-53U16. ALTERNATIVE COMPONENT PACKAGES FOR CLIMATE ZONE 16

Component	Package		
	A	B	C
BUILDING ENVELOPE			
Insulation Minimums			
Ceiling	R 38	R 38	R 30
Wall ¹	R 19 (R 9.5)	R 19 (R 7.0)	R 19 (R 7.5)
Slab Floor Perimeter	R 7	R 7	R 7
Raised Floor	R 19	R 19	R 19
Glazing			
Maximum U Value	0.65	0.65	0.65
Maximum Total Area	no requirement	16.0%	14.0%
Maximum Total Nonsouth Facing Area	9.6%	no requirement	no requirement
Minimum South Facing Area	6.4%	no requirement	no requirement
Shading			
South Facing Glazing	not required	not required	not required
West Facing Glazing	not required	not required	not required
Thermal Mass	required	not required	not required
Continuous Infiltration Barrier	not required	required	not required
Electrical Outlet Plate Gaskets	not required	required	not required
SPACE CONDITIONING SYSTEM			
Heating System Type ²	gas	gas	gas
Air-to-Air Heat Exchanger	not required	required	not required
DOMESTIC WATER HEATING SYSTEM TYPE			
	gas, heat pump, or solar with any type of backup heat	gas, heat pump, or solar with any type of backup heat	solar with gas backup heat

1. The value in parentheses is the R-value for the entire wall assembly if the wall weight exceeds 40 pounds per square foot. The insulation must be integral with or installed on the outside of the exterior mass. The inside surface of the thermal mass, including plaster or gypsum board in direct contact with the masonry wall, shall be exposed to the room air. The exterior wall used to meet the R-value in parentheses cannot also be used to meet the above thermal mass requirement.
2. Where natural gas is not available, zonally controlled electric resistance or radiant heating systems may be used.

2-5352. Mandatory Features and Devices.

Any new building of occupancy R (except apartment houses with four or more habitable stories and hotels) shall have all of the following features and devices:

- (a) Ceiling Insulation. The opaque portions of ceilings separating conditioned spaces from unconditioned spaces shall meet the requirements of either (1) or (2) below.
- (1) Ceilings shall be insulated between framing members with insulation having an installed thermal resistance of R-19 or greater.
- Insulation which is not penetrated by framing members may meet an equivalent minimum R-value which includes the effects of framing members on the above R-19 insulated ceiling.
- (2) The weighted average U-value of ceilings shall not exceed that which would result from using the insulation indicated in Section 2-5352(a)(1), including the effects of framing members.
- (b) Loose Fill Insulation. When loose fill insulation is installed, the minimum installed weight per square foot shall conform with the insulation manufacturer's installed design density per square foot at the manufacturer's labeled R value.
- (c) Wall Insulation. The opaque portions of wood frame walls separating conditioned spaces from unconditioned spaces shall meet the requirements of either (1) or (2) below.
- (1) Wood-framed walls shall be insulated between framing members with insulation having an installed thermal resistance of R-11 or greater. Foundation walls of heated basements or heated crawl spaces shall be insulated above the adjacent outside ground line with insulation having an installed thermal resistance of R-7.
- Insulation which is not penetrated by framing members may meet an equivalent minimum R-value which includes the effects of framing members on the above R-values.
- (2) The weighted average U-value of walls shall not exceed that which would result from using the insulation indicated in Section 2-5343(c)(1), including the effects of framing members.

(d) Infiltration Control.

- (1) Doors and windows between conditioned and unconditioned spaces, such as garages and closets for central forced air gas furnaces (which use outside air for combustion) shall be fully weather stripped.
- (2) The following openings in the building envelope shall be caulked or otherwise sealed to limit infiltration:
 - (A) Exterior joints around windows and door frames, between wall soleplates and floors, and between exterior wall panels;
 - (B) Openings for plumbing, electricity and gas lines in walls, ceilings, and floors;
 - (C) Openings in the attic floor (such as where ceiling panels meet interior and exterior walls and masonry fireplaces); and
 - (D) All other such openings in the building envelope.
- (3) Manufactured doors and windows shall be certified and labeled indicating that they meet the appropriate standards listed in Table 2-53V.

TABLE 2-53V. STANDARDS FOR DOORS AND WINDOWS

Type	Standard
Aluminum Prime Windows	ANSI/AAMA 302.9 - 1977
Aluminum Sliding Glass Doors	ANSI/AAMA 402.9 - 1977
Aluminum Combination Storm Windows	ANSI/AAMA 1002.10 - 1980
Aluminum Storm Doors	ANSI/AAMA 1102.7 - 1977
Wood Flush Doors	ANSI/NWMA I.S.1 - 80
Wood Windows	ANSI/NWMA I.S.2 - 80
Wood Sliding Patio Doors	ANSI/NWMA I.S.3 - 70
Ponderosa Pine Doors	ANSI/NWMA I.S.5 - 73
Wood Panel Doors	FHDA/7 - 79
Exterior Wood Swinging Doors	NWMA I.S.610 - 79
Sealed Insulating Glass Units	ASTM E774 - 81

2-5352(d) 5

(4) Fan or other exhaust systems exhausting air from the building to the outside shall be provided with backdraft dampers or automatic dampers to prevent air leakage.

(5) Masonry and factory-built fireplaces shall have the following:

(A) Tight fitting closeable metal or glass doors covering the entire opening of the firebox (this requirement may be omitted if such doors would interfere with devices permanently installed in the fireplace which are designed to increase the circulation of heat);

(B) A combustion air intake to draw air from the outside of the building directly into the firebox, which is at least six square inches in area and is equipped with a readily accessible, operable, and tight fitting damper; and

(C) Tight fitting flue damper with a readily accessible control.

Continuous burning pilot lights and the use of indoor air for cooling a firebox jacket, when that indoor air is vented to the outside of the building, are prohibited.

(e) Vapor Barriers. In Climate Zones 1, 14, and 16 shown in Figure 2-53G, a vapor barrier shall be installed on the conditioned space side of all insulation in all exterior walls, unvented attics, and unvented crawl spaces to protect insulation from condensation.

(f) Ducts. Ducts shall be constructed, installed, and insulated according to Chapter 10 of the State Mechanical Code (Title 24, Part 4).

(g) Space Conditioning Equipment Sizing.

(1) Natural gas and liquefied petroleum gas central furnaces shall be sized to meet at least one of the following requirements:

(A) The total output heating capacity of furnaces in the building shall be less than 45,000 Btu/hr; or

(B) Output heating capacity shall be less than 1.3 times the sum of the design heat loss rate for the heating zone being serviced by the furnace and 10 Btu per hour per square foot of conditioned floor area in the zone; or

(C) Seasonal efficiency shall exceed 67 percent by one percent for every 7,000 Btu/hr the output heating capacity exceeds either the building design heat loss rate or 45,000 Btu/hr, whichever is greater.

The furnace output heating capacity shall be determined using the method described in the Department of Energy test procedures for measures of energy consumption in 42 Federal Register 20147-20181 (May 10, 1978).

NOTE: Effective December 22, 1982 or December 22, 1984, the 67 percent seasonal efficiency shall be increased to 71 percent seasonal efficiency. See Section 2-5306(c) for details of effective dates.

- (2) Heating and cooling equipment shall be sized in accordance with the building design heat loss rate and heat gain rate, using a method set forth by the Executive Director, based on the 1979 ASHRAE Handbook and Product Directory, Equipment Volume, 1980 Systems Volume and 1981 Fundamentals Volume.
 - (3) Indoor design dry bulb air temperatures shall be 70°F for heating and 78°F for cooling. Outdoor design air temperatures shall be those listed in the 1 percent or 0.2 percent Winter Dry Bulb column for heating and the 2-1/2 percent or 0.5 percent Summer Dry Bulb and Wet Bulb columns for cooling, based on whether the percentages are percent-of-season or percent-of-year respectively in ASHRAE publications: Recommended Outdoor Design Temperatures, Northern California, 1977, and Recommended Outdoor Design Temperatures, Southern California, 1972.
- (h) Setback Thermostats. Thermostatically controlled heating or cooling systems, except electric heat pumps, shall have an automatic thermostat with a clock mechanism which the building occupant can manually program to automatically set back the thermostat set points for at least 2 periods within 24 hours.
- (i) Water Heating System Insulation.
- (1) Storage type water heaters and storage and backup tanks for solar water heating systems shall be externally wrapped with insulation having an installed thermal resistance of R-12 or greater.
 - (2) Piping in unconditioned space leading to and from water heaters shall be insulated with an installed thermal resistance of R-3 or greater for the five feet of pipe closest to the water heater, or whatever shorter length is in unconditioned space.
- (j) Pipe Insulation. Steam and steam-condensate return piping and recirculating hot water piping in attics, garages, crawl spaces, or unheated spaces other than between floors or in interior walls shall be insulated to provide maximum loss of not more than 50 Btu/hour per linear foot for piping up to and including 2 inch nominal diameter and 100 Btu/hour per linear foot for larger sizes.

(k) Swimming Pool Heating.

- (1) Any new or replacement fossil-fueled swimming pool heater system in a residential occupancy shall be equipped with all of the following:
 - (A) An ON-OFF switch mounted on the outside of the heater for easy access to allow shutting off the operation of the heater without adjusting the thermostat setting and to allow restarting without relighting the pilot light.
 - (B) A permanent weatherproof plate or card, easily readable giving instruction for the energy efficient operation of the swimming pool and for the proper care of swimming pool water when a swimming pool cover is used.
 - (C) A length of plumbing (36" minimum) between the filter and the fossil fuel heater to allow for the future addition of solar heating equipment.
- (2) Any new or replacement fossil-fueled swimming pool heater shall have a thermal efficiency of at least 75 percent when tested in accordance with ANSI Z21.56-1979 and shall be so identified on the plans and the heater.
- (3) Outdoor pools equipped with a fossil fuel or electric heater shall also be equipped with a pool cover.
- (4) Time clocks shall be installed on any new or replacement pool circulation pump not already so equipped so that the pump can be set to run in the off-peak electric demand period (unless required to operate an active solar pool heating system) and for the minimum time necessary to maintain the water in a clear and sanitary condition in keeping with applicable public health standards. Where public health standards require 24-hour operation, time clocks shall not be required.
- (5) All new pools shall be equipped with directional inlets which provide for adequate mixing of the pool water.

- (l) Gas Cooking Appliances. Gas-fired household cooking appliances with continuously burning pilots, except those designed to burn only liquefied petroleum gases and those which do not have an electrical line voltage supply connection and have only one continuous burning pilot light consuming less than 150 British thermal units per hour, shall not be installed in a building of occupancy R.
- (m) Lighting. Lamps used in luminaires for general lighting in kitchens and bathrooms shall have an efficacy of not less than 25 lumens per watt. Luminaires which are the only lighting in a kitchen or bathroom will be considered general lighting. Lighting to be used only for specific visual tasks or decorative effect are exempt from this requirement. Such exempt lighting includes luminaires that are meant to light only a specific task area such as a kitchen counter or sink, a dining table, or a bathroom mirror.

NOTE: Authority cited: Public Resources Code, Section 25402.
Reference: Public Resources Code, Section 25402.

Sections 2-5361 through 2-5365 after July 13, 1982 will apply only to apartment buildings with four or more habitable stories and hotels and are not included in this excerpt. Copies may be obtained by writing to the following address and asking for the Nonresidential Building Standards:

California Energy Commission
Publications Office
1111 Howe Avenue
Sacramento, CA 95825

(916) 920-6216

APPENDIX 2-53A

STANDARDS REFERENCED IN ENERGY CONSERVATION REGULATIONS

STATE OF CALIFORNIA

Appliance Efficiency Regulations

Standards for Insulating Material

Nonresidential Design Manual

Residential Design Manual

Various directories for certified appliances

Directory of Certified Insulating Materials

Available from: California Energy Commission
Publications Office
1111 Howe Avenue
Sacramento, CA 95825

(916) 920-6216

INTERNATIONAL CONFERENCE ON BUILDING OFFICIALS

Uniform Building Code, 1979 Edition

Uniform Mechanical Code, 1976 Edition

Available from: International Conference of Building Officials
5360 South Workman Mill Road
Whittier, CA 90601

AIR-CONDITIONING AND REFRIGERATION INSTITUTE

ARI 210-81	Standard for Unitary Air-Conditioning Equipment
ARI 240-81	Standard for Air-Source Unitary Heat Pump Equipment
ARI 320-81	Standard for Water-Source Heat Pumps
ARI 340-76	Standard for Commercial and Industrial Unitary Heat Pump Equipment

- ARI 360-75 Standard for Commercial and Industrial Unitary Air-Conditioning Equipment
- ARI 520-78 Standard for Positive Displacement Refrigerant Compressors, Compressor Units, and Condensing Units
- ARI 550-77 Standard for Centrifugal and Rotary Water-Chilling Packages
- ARI 560-75 Standard for Absorption Water-Chilling Packages
- ANSI/ARI 590-1976 Standard for Reciprocating Water-Chilling Packages

Available from: Air-Conditioning and Refrigeration Institute
 1815 North Fort Myer Drive
 Arlington, VA 22209
 703-524-8000

AMERICAN SOCIETY OF HEATING, REFRIGERATING, AND AIR-CONDITIONING ENGINEERS
 (NATIONAL PUBLICATIONS)

Handbook and Product Directory

Equipment Volume, 1979 Edition.
 Systems Volume, 1980 Edition.
 Fundamentals Volume, 1981 Edition.

Standards

- ASHRAE 22-71 Methods of Testing for Rating Water Cooled Refrigerant Condensers
- ASHRAE 24-71 Methods of Testing for Rating Liquid Coolers
- ANSI/ASHRAE 55-1981 Thermal Environment Conditions for Human Occupancy
- ASHRAE 62-73 Standards for Natural and Mechanical Ventilation

Available from: American Society of Heating, Refrigerating, and
 Air-Conditioning Engineers
 1791 Toulie Circle N.E.
 Atlanta, GA 30329
 404-636-8400

AMERICAN SOCIETY OF HEATING, REFRIGERATING, AND AIR CONDITIONING ENGINEERS
 (REGIONAL PUBLICATIONS)

Recommended Outdoor Design Temperatures for Northern California, 1977

Available from: ASHRAE
Golden Gate Chapter
126 Post Street
San Francisco, CA
415-982-3042

Recommended Outdoor Design Temperatures for Southern California, Arizona,
Nevada, 1972

Available from: ASHRAE
Southern California Chapter

AMERICAN NATIONAL STANDARDS - Z21 SERIES

ANSI Z21.10.3 - 1975	Standard for Gas Water Heaters, Volume III Circulating Tank, Instantaneous and Large Auto- matic Storage Type Water Heaters
ANSI Z21.11.1 - 1977	Standard for Gas-Fired Room Heaters, Volume I, Vented Room Heaters
ANSI Z21.40.1 - 1973	Standard for Gas-Fired Absorption Summer Air Conditioning Appliances
ANSI Z21.44 - 1977	Standard for Gas-Fired Gravity and Fan Type Direct Vent Wall Furnaces
ANSI Z21.47 - 1978	Standard for Gas-Fired Gravity and Fan Type Central Furnaces
ANSI Z21.48 - 1979	Standard for Gas-Fired Gravity and Fan Type Floor Furnaces
ANSI Z21.49 - 1979	Standard for Gas-Fired Gravity and Fan Type Vented Wall Furnaces
ANSI Z21.56 - 1979	Standard for Gas-Fired Swimming Pool Heaters

Available from: American Gas Association Laboratories
8510 East Pleasant Valley Road
Cleveland, OH 44131

ARCHITECTURAL ALUMINUM MANUFACTURERS ASSOCIATION

ANSI/AAMA 302.9 - 1977	Specifications for Aluminum Prime Windows
ANSI/AAMA 402.9 - 1977	Specifications for Aluminum Sliding Glass Doors

ANSI/AAMA 1002.10--1980 Specifications for Aluminum Combination Storm
Windows for External Application

ANSI/AAMA 1102.7--1977 Specification for Aluminum Storm Doors

Available from: Architectural Aluminum Manufacturers Association
35 East Wacker Drive
Chicago, IL 60601
(312) 782-8256

NATIONAL WOODWORK MANUFACTURERS ASSOCIATION

ANSI/NWMA I.S. 1-80 Standard for Wood Flush Doors

ANSI/NWMA I.S. 2-80 Standard for Wood Window Units

ANSI/NWMA I.S. 3-70 Standard for Wood Sliding Patio Doors

ANSI/NWMA I.S. 5-73 Standard for Ponderosa Pine Doors

NWMA I.S. 610-79 Standard for Exterior Wood Swinging Doors

Available from: National Woodwork Manufacturers Association
205 West Touhy Avenue
Park Ridge, IL 60068
312-823-6747

SHEET METAL AND AIR CONDITIONING CONTRACTORS NATIONAL ASSOCIATION

"Applicable Standards"

FIR AND HEMLOCK DOOR ASSOCIATION

FHDA/7-79 Industry Standard for Douglas Fir, Western Hemlock, and
Sitka Spruce Doors.

Available from: Fir and Hemlock Door Association
Yeon Building
Portland, OR 97204
503-224-3930

AMERICAN SOCIETY FOR TESTING AND MATERIALS

ASTM E774-81 Specifications for Testing Seal Durability of Sealed
Insulating Glass Units.

Available from: American Society for Testing and Materials
1916 Race Street
Philadelphia, PA 19103
215-299-5400

CALIFORNIA ADMINISTRATIVE CODE

TITLE 24

(STATE BUILDING STANDARDS CODE)

Part 4

(State Mechanical Code)

Chapter 4-10 Ducts

CHAPTER 4-10

DUCTS

4-1000. Basic Provisions.

- (a) Except as provided herein, Chapter 10 of the UMC, as set forth in the table below, is hereby adopted by reference for the purpose of providing the basic mechanical regulations relating to ducts.
- (b) The following table identifies the sections of the UMC and this part which have been adopted by the listed agencies. See Section 4-104 for explanations of the abbreviations used in the table, the application of the regulations, and their intended use.

TABLE NO. 4-10A

Code Section	CEC
Entire Chapter	X ⁵
Entire Chapter, except as noted in this table	
1005	X ⁶

5 CEC Adopted by reference for new buildings of occupancy R (except apartment houses with four or more habitable stories and hotels). See Section 2-5352(f).

6 CEC Adopted by reference for Occupancies A, B, E, and H; See Section 2-5334. Adopted by reference for Occupancy R; see Section 2-5363. Adopted by reference for all occupancies under specified installation conditions; see Section 2-5305.

NOTE: Authority cited: Public Resources Code, Section 25402, 25922.
Reference: Public Resources Code, Section 25402, 25922.