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ENERGY EFFICIENCY STANDARDS FOR **RESIDENTIAL AND NONRESIDENTIAL BUILDINGS**

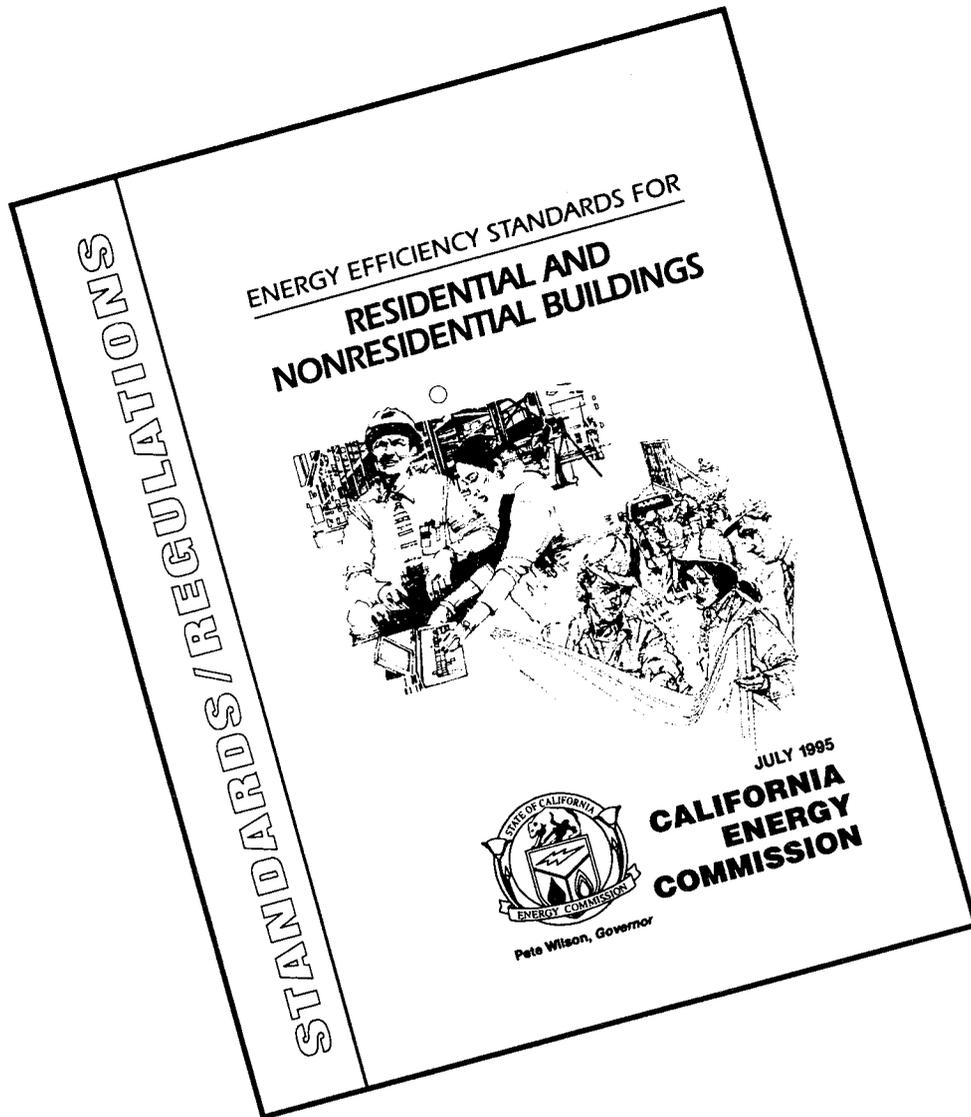


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CALIFORNIA ENERGY COMMISSION

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ADMINISTRATIVE REGULATIONS

**CALIFORNIA CODE OF REGULATIONS
TITLE 24, PART 1**

ARTICLE 1.—ENERGY BUILDING REGULATIONS

Section 10-101. Scope.

- (a) This article contains administrative regulations relating to the energy building regulations in Title 24, Part 6. This article applies to all residential and nonresidential buildings.
- (b) Nothing in this article lessens any necessary qualifications or responsibilities of licensed or registered building professionals or other designers or builders, or the duties of enforcement agencies, that exist under state or local law.

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

Section 10-102. Definitions.

In this article the following definitions apply:

“Alternative Calculation Method Approval Manual” or “ACM Manual” means the Alternative Calculation Method (ACM) Approval Manual for the 1995 Energy Efficiency Standards for Nonresidential buildings, March, 1995, (P400-95-011) for nonresidential buildings, hotels, and multi-family residential buildings with four or more stories and the Alternative Calculation Method (ACM) Approval Manual for the 1995 Energy Efficiency Standards for Residential Buildings, April 1992, (P400-92-003) for all single family and low-rise multi-family residential buildings.

“Appliance Standards” means the California Code of Regulations, Title 20, Chapter 2, Subchapter 4, Article 4, Sections 1601 to 1608.

“Approved Calculation Method” means a Public Domain Computer Program approved under Section 10-109(a), or any Alternative Calculation Method approved under Section 10-109(b).

“Building Permit” means an electrical, plumbing, mechanical, building, or other permit or approval, that is issued by an enforcement agency, and that authorizes any construction that is subject to Part 6.

“Commission” means the State Energy Resources Conservation and Development Commission.

“Compliance Approach” means any one of the allowable methods by which the design and construction of a building may be demonstrated to be in compliance with Part 6. The compliance approaches are the performance compliance approach and the prescriptive compliance approach. The requirements for each compliance approach are set forth in Section 100(d)2 of Part 6.

“Conditioned Floor Area” means “conditioned floor area” as defined in Section 101(b) of Part 6.

“Energy Budget” means “energy budget” as defined in Section 101(b) of Part 6.

“Enforcing Agency” means the city, county, or state agency responsible for issuing a building permit.

“Executive Director” means the Executive Director of the Commission.

“HVAC System” means “HVAC system” as defined in Section 101(b) of Part 6.

“Manufactured Device” means “manufactured device” as defined in Section 101(b) of Part 6.

“Part 6” means California Code of Regulations, Title 24, Part 6.

“Public Adviser” means the Public Adviser of the Commission.

“R-Value” means the measure of the resistance of a material or building component to the passage of heat in $[\text{hr} \times \text{ft}^2 \times \text{°F}] \div \text{Btu}$.

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

Section 10-103. Permit, Certificate, Informational, and Enforcement Requirements for Designers, Installers, Builders, Manufacturers, and Suppliers.**(a) Documentation.****(1) Certificate of Compliance.**

The Certificate(s) of Compliance described in Section 10-103 shall be signed by the person(s) responsible for the building design to certify conformance with Part 6. The signer(s) shall be eligible under Division 3 of the Business and Professions Code to sign such documents. If more than one person has responsibility for building design, each person may sign the document or documents applicable to that portion of the design for which the person is responsible. Alternatively, the person with chief responsibility for design may prepare and sign the document for the entire design.

Subject to the preceding paragraph, persons who prepare energy compliance documentation shall sign a statement that the documentation is accurate and complete.

(2) Application for a building permit.

Each application for a building permit subject to Part 6 shall contain at least one copy of the documents listed in Sections 10-103(a)2.A., 10-103(a)2.B., and 10-103(a)2.C.

- (A)** For all new buildings designated to allow a conditioned use of an occupancy group or type regulated by Part 6 the applicant shall file the appropriate Certificate(s) of Compliance on the plans. The Certificate(s) shall indicate the features and performance specifications needed to comply with Part 6, and shall be approved by the local enforcement agency by stamp or authorized signature. The Certificate(s) of Compliance and supporting documentation shall be readily legible and of substantially similar format and informational order and content to the appropriate Certificate(s) of Compliance and supporting documentation in the appropriate Residential or Nonresidential Manual, as defined in Part 6.
- (B)** Plans and specifications submitted with each application for a building permit shall show the characteristics of each feature, material, component, and manufactured device proposed to be installed in order to have the building meet the requirements of Part

6, and of any other feature, material, component, or manufactured device that Part 6 requires be indicated on the plans and specifications. If any characteristic is materially changed before final construction and installation, such that the building may no longer comply with Part 6, the building must be brought back into compliance, and so indicated on amended plans, specifications, and Certificate(s) of Compliance and shall be submitted to the enforcement agency. Such characteristics shall include the efficiency (or other characteristic regulated by Part 6) of each device.

- (C) All documentation necessary to demonstrate compliance for the building, and of the sections of Part 6 with which the building is intended to comply shall be submitted with each application for a building permit. The forms used to demonstrate compliance shall be readily legible and of substantially similar format and informational order and content to the appropriate forms in the Residential or Nonresidential Manual, as defined in Part 6.

(3) Installation Certificate.

- (A) The person with overall responsibility for construction or the person or persons responsible for the installation of regulated manufactured devices shall post, or make available with the building permit(s) issued for the building, the installation certificate(s) for manufactured devices regulated by the appliance standards or Part 6. Such installation certificate(s) shall be made available to the enforcement agency for all appropriate inspections.

These certificates shall:

1. Identify features required to verify compliance with the appliance standards and Part 6.
2. Include a statement indicating that the installed devices conform to the appliance standards and Part 6 and the requirements for such devices given in the plans and specifications approved by the local enforcement agency.
3. State the number of the building permit under which the construction or installation was performed.

4. Be signed by the individual eligible under Division 3 of the Business and Professions Code to accept responsibility for construction, or their authorized representative. If more than one person has responsibility for building construction, each person may prepare and sign the part of the document applicable to the portion of construction for which they are responsible; alternatively, the person with chief responsibility for construction may prepare and sign the document for the entire construction.
 - (B) The enforcement agency may require the person with overall responsibility for the construction to provide any other reasonable information to determine that the building as constructed is consistent with approved plans and specifications and complies with Part 6.
 - (C) If construction on any portion of the building subject to Part 6 will be impossible to inspect because of subsequent construction, the enforcement agency may require the installation certificate(s) to be posted upon completion of that portion.
- (4) Insulation Certificate.

After installing wall, ceiling, or floor insulation, the installer shall make available to the enforcement agency or post in a conspicuous location in the building a certificate signed by the installer stating that the installation is consistent with the plans and specifications described in Section 10-103(a)2.A. and for which the building permit was issued and conforms with the requirements of Part 6. The certificate shall also 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 installed design density for the desired R-value.

EXCEPTION: Enforcing agencies may exempt nonresidential buildings that have no more than 1,000 square feet of conditioned floor area in the entire building and an occupant load of 49 persons or less from the documentation requirements of Section 10-103(a), provided a statement of compliance with Part 6 is submitted and signed by a licensed engineer or the licensed architect with chief responsibility for the design.

(b) Operating and Maintenance Information to be Provided by Builder.

- (1) **Operating Information.** The builder shall provide the building owner at occupancy the appropriate Certificate(s) of Compliance and a list of the features, materials, components, and mechanical devices installed in the building and instructions on how to operate them efficiently. The instructions shall be consistent with specifications set forth by the Executive Director.

For residential buildings, such information shall, at a minimum, include information indicated on forms Certificate of Compliance (CF-1R), Mandatory Measures (MF-1R), Installation Certificate (CF-6R), Insulation Certificate (IC-1), and a manual which provides all information specified in this Section 10-103(b). The *Home Energy Manual* (P400-92-031, July 1992) may be used to meet the requirement for providing this manual.

For nonresidential buildings, such information shall, at a minimum, include information required by the Certificates of Compliance, forms ENV-1, MECH-1 and LTG-1, an installation certificate and an insulation certificate.

For dwelling units, buildings or tenant spaces which are not individually owned and operated, or are centrally operated, such information shall be provided to the person(s) responsible for operating the feature, material, component or mechanical device installed in the building.

- (2) **Maintenance Information.** The builder shall provide to the building owner at occupancy maintenance information for all features, materials, components, and manufactured devices that require routine maintenance for efficient operation. Required routine maintenance actions shall be clearly stated and incorporated on a readily accessible label. The label may be limited to identifying, by title and/or publication number, the operation and maintenance manual for that particular model and type of feature, material, component, or manufactured device.

For dwelling units, buildings or tenant spaces which are not individually owned and operated, or are centrally operated, such information shall be provided to the person(s) responsible for maintaining the feature, material, component, or mechanical device installed in the building.

- (3) **Ventilation Information.** For nonresidential buildings, the builder shall provide the building owner at occupancy a description of the quantities of outdoor and recirculated air that the ventilation systems are designed to

provide to each area. For buildings or tenant spaces which are not individually owned and operated, or are centrally operated, such information shall be provided to the person(s) responsible for operating and maintaining the feature, material, component, or mechanical device installed in the building.

(c) **Equipment Information to be Provided by Manufacturer or Supplier.** The manufacturer or supplier of any manufactured device shall, upon request, provide to building designers and installers information about the device. The information shall include the efficiency (and other characteristics regulated by Part 6).

(d) **Enforcement Agency Requirements.**

(1) **Permits.** An enforcement agency shall not issue a building permit for any construction unless the enforcement agency determines in writing that the construction is designed to comply with the requirements of Part 6 that are in effect on the date the building permit was applied for.

If a building permit has been previously issued, there has been no construction under the permit, and the permit has expired, the enforcement agency shall not issue a new permit unless the enforcement agency determines in writing that the construction is designed to comply with the requirements of Part 6 in effect on the date the new permit is applied for.

“Determines in writing” includes but is not limited to approval of a building permit with a stamp normally used by the enforcement agency.

(2) **Inspection.** The enforcement agency shall inspect new construction to determine whether it is consistent with the agency’s approved plans and specifications, and complies with Part 6. Final occupancy permits shall not be issued until such consistency is verified. For occupancy group R-3, final inspection shall not be complete until such consistency is verified.

Such verification shall include determining that all installed manufactured devices, regulated by the appliance standards or Part 6, are indicated on the installation certificate and are consistent with approved plans. This certificate shall include information specified in Section 10-103(a)(3)(A).

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

Section 10-104. Exceptional Designs.

NOTE: See Section 10-109 for approval of calculation methods and Alternative Component Packages.

- (a) **Requirements.** If a building permit applicant proposes to use a performance compliance approach, and the building designs cannot be adequately modeled by an approved calculation method, an applicant shall be granted a building permit if the Commission finds:
- (1) that the design cannot be adequately modeled with an approved calculation method;
 - (2) using an alternative evaluation technique, that the design complies with Part 6; and
 - (3) that the enforcement agency has determined that the design complies with all other legal requirements.
- (b) **Applications.** The applicant shall submit four copies of a signed application with the following materials to the Executive Director:
- (1) A copy of the plans and specifications required by Section 10-103(a)2.A.;
 - (2) A statement explaining why meeting the energy budget cannot be demonstrated using an approved calculation method;
 - (3) Documentation from the enforcement agency stating that
 - (A) meeting the energy budget requirements cannot be demonstrated using an approved calculation method, and
 - (B) the design complies with all other legal requirements; and
 - (4) A detailed evaluation of the energy consumption of the proposed building and the building's materials, components, and manufactured devices proposed to be installed to meet the requirements of Part 6, using an alternative evaluation technique. The evaluation shall include a copy of the technique, instructions for its use, a list of all input data, and all other information required to replicate the results.

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

Section 10-105. Enforcement by the Commission.

- (a) **Where There is No Local Enforcement Agency.** Before new construction may begin in an area where there is no local enforcement agency, and on any proposed governmental agency building for which there is no enforcement agency, the Executive Director must determine in writing that the building design conforms to the requirements of Part 6. The person proposing to construct the building shall submit the information described in Section 10-103(a)2. and 10-103(a)3. to the Executive Director when such a determination is sought.
- (b) **Where the Local Enforcement Agency Fails to Enforce.** If a local enforcement agency fails to enforce the requirements of this article or of Part 6, the Commission, after furnishing 10 days written notice, may condition building permit issuance on submission of the information described in Sections 10-103(a)2. and 10-103(a)3. to the Executive Director and on his or her written determination that proposed construction conforms to the requirements of Part 6.

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

Section 10-106. Locally Adopted Energy Standards.

- (a) **Requirements.** Local governmental agencies may adopt and enforce energy standards for new buildings, provided the Commission finds that the standards will require buildings to be designed to consume no more energy than permitted by Part 6. Such local standards include but are not limited to adopting the requirements of Part 6 before their effective date, requiring additional energy conservation measures, or setting more stringent energy budgets. Local adoption of the requirements of Part 6 before their effective date is a sufficient showing that the local standards meet the requirements of this section and Section 25402.1(f)(2) of the Public Resources Code; in such a case only the documentation listed in Section 10-106(b), and a statement that the standards are those in Part 6, need be submitted.

- (b) **Documentation Application.** Local governmental agencies wishing to enforce locally adopted energy conservation standards shall submit four copies of an application with the following materials to the Executive Director:
- (1) The proposed local energy standards.
 - (2) A study with supporting analysis showing how the local agency determined energy savings.
 - (3) A statement that the local standards will require buildings to be designed to consume no more energy than permitted by Part 6.
 - (4) The basis of the agency's determination that the standards are cost effective.

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

Section 10-107. Interpretations.

- (a) The Commission may make a written determination as to the applicability or interpretation of any provision of this article or of Part 6, upon written application, if a dispute concerning a provision arises between an applicant for a building permit and the enforcement agency, and the dispute has been heard by the local board of permit appeals or other highest local review body. Notice of any such appeal, including a summary of the dispute and the section of the regulations involved, shall if possible be sent to the Commission by the enforcing agency 15 days before the appeal is heard, and the result of the appeal shall be sent to the Commission within 15 days after the decision is made. Either party to the dispute may apply for a determination but shall concurrently deliver a copy of the application to the other party. The determinations are binding on the parties.
- (b) The Executive Director may, upon request, give written advice concerning the meaning of any provision of this article or of Part 6. Such advice is not binding on any person.

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

Section 10-108. Exemption.

- (a) **Requirements.** The Commission may exempt any building from any provision of Part 6 if it finds that:
- (1) Substantial funds had been expended in good faith on planning, designing, architecture, or engineering of the building before the adoption date of the provision.
 - (2) Compliance with the requirements of the provision would be impossible without both substantial delays and substantial increases in costs of construction above the reasonable costs of the measures required to comply with the provision.
- (b) **Application.** The applicant shall submit four copies of a signed application with the following materials to the Executive Director:
- (1) A summary of the claimant's contracts for the project;
 - (2) A summary of internal financial reports on the project;
 - (3) Dated schedules of design activities; and
 - (4) A progress report on project completion.

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

Section 10-109. Calculation Methods and Alternative Component Packages.

NOTE: See Section 10-104 for approval of exceptional designs.

- (a) **Public Domain Computer Programs.** In addition to the present approved public domain computer programs, the Commission may, upon written application or its own motion, approve additional public domain computer programs that may be used to demonstrate that proposed building designs meet energy budgets.
- (1) The Commission shall ensure that users' manuals or guides for each approved program are available.

- (2) The Commission shall approve a program only if it predicts energy consumption substantially equivalent to that predicted by the computer program used by the Commission to set energy budgets.
- (b) **Alternative Calculation Methods (All Occupancies).** In addition to public domain computer programs, the Commission may approve alternative calculation methods (ACMs) that applicants for building permits may then use to demonstrate compliance with the performance standards (energy budgets) in Part 6.
- (1) **General requirements.** To obtain approval for an ACM, the proponent shall submit an application that demonstrates that the ACM:
 - (A) Makes no changes in any input parameter values specified by the Commission;
 - (B) Provides input and output documentation that facilitates the enforcement agency's review and meets the formatting and content criteria found in the appropriate ACM Manual;
 - (C) Is supported by clear and concise instructions for using the method to demonstrate that the energy budget requirements of Part 6 are met;
 - (D) Is reliable and accurate relative to the appropriate public domain computer program; and
 - (E) Establishes factors that, when applied to the method's outputs, result in energy budgets for that alternative calculation method that are equivalent to those in Part 6, when the buildings used to develop the energy budgets in Part 6 are modeled.
 - (2) **Procedural requirements for Alternative Calculation Methods.** In order to obtain approval of an ACM, the applicant must comply with the requirements, specifications, and criteria set forth in the appropriate ACM Manual. The ACM Manual specifies application requirements, minimum modeling capabilities, required output forms and instructions, input assumptions, testing requirements, test approval criteria, vendor requirements, and other related requirements. The requirements, specifications, and criteria in the ACM Manuals for the 1995 energy efficiency standards for residential and nonresidential buildings are hereby incorporated by reference.

NOTE: Interested persons may obtain copies of the ACM Manuals from the Energy Commission's Publications Unit.

- (3) Application. The applicant shall submit four copies of a signed application form specified by the Executive Director. The application shall include the following materials:
 - (A) The method's analytical capabilities and limitations with respect to the occupancies, designs, materials, and devices covered by Part 6; and
 - (B) A demonstration that the criteria in Section 10-109(b) are met.
 - (C) Each of the items on the "Application Checklist" in the appropriate ACM Manual.
 - (D) An initial fee of one thousand dollars (\$1000). The total fee shall cover the Commission's cost of reviewing and analyzing the proposed method. After the Commission determines the total costs, if the costs exceed the initial fee, the Commission shall assess additional fees to cover those costs; if the costs are less than the initial fee, the Commission shall refund the difference to the applicant.
- (4) Exceptional Methods. If the alternative calculation method analyzes designs, materials, or devices that cannot be adequately modeled using the public domain computer programs, the method may be approved as an exceptional method. Applications for approval of exceptional methods shall include theoretical and empirical information that verify the method's accuracy, and shall also include the other documentation and fees required by subsection 10-109(b).
- (5) Approval. The Commission may approve a method unconditionally, may restrict approval to specified occupancies, designs, materials, or devices, or may reject the application.
- (6) Resubmittal. An applicant may resubmit a rejected method or may request modification of a restricted approval. Such application shall include the information specified in Section 10-109(b) and shall indicate how the method has been changed to enhance its accuracy or capabilities.

- (7) **Modification.** Whenever an approved calculation method is changed in any way, the method shall be resubmitted under this Section for reapproval. The Executive Director may waive any of the requirements of this paragraph for nonsubstantive changes.
- (c) The Commission may modify or withdraw certification of a program or method under Section 10-109(a) or 10-109(b) based upon approval of other programs or methods that are more suitable.
- (d) **Alternative Component Packages.** The Commission may approve any alternative component package, in addition to the packages in Sections 143(a) and 151(f) of Part 6, which it determines will meet the energy budgets and is likely to apply to a significant percentage of new buildings or to a significant segment of the building construction and design community. Applications for approval of packages shall use application forms specified by the Executive Director and shall be subject to the same fee requirements set forth in subsection (b).
- (e) **Publication of Commission Determinations.** The Executive Director shall annually publish a manual, newsletter, or other administrative guide containing determinations made by the Commission pursuant to this section on or before December 31 of the calendar year.

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

Section 10-110. Procedures for Consideration of Applications Under Sections 10-104, 10-106, 10-108, and 10-109.

- (a) If the application is complete, the Executive Director shall make a copy or copies of the application available to interested parties. Comments from interested parties must be submitted within 60 days after acceptance of the application.
- (b) Within 75 days of receipt of an application, the Executive Director may request any additional information needed to evaluate the application. If the additional information is incomplete, consideration of the application will be delayed until the applicant submits complete information.
- (c) Within 75 days of receipt of the application, the Executive Director may convene a workshop to gather additional information from the applicant and other interested parties. Interested parties will have 15 days after the workshop to submit additional information regarding the application.

- (d) Within 90 days after the Executive Director receives the application or within 30 days after receipt of complete additional information requested under Section 10-110(b) or within 30 days after the receipt of additional information submitted by interested parties under Section 10-110(c), whichever is later, the Executive Director shall submit to the Commission a written recommendation on the application.
- (e) The application and the Executive Director's recommendation shall be placed on the consent calendar and considered at the next business meeting after submission of the recommendation. The matter may be removed from the consent calendar at the request of any person.
- (f) The Executive Director may charge a fee to recover the costs of processing and reviewing applications.
- (g) All applicants have the burden of proof to establish that their applications should be granted.

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

Section 10-111. Certification and Labeling of Fenestration Product U-Values.

This section establishes the rules for implementing labeling and certification requirements relating to U-values for fenestration products under Section 116(a) of the California Energy Code (Title 24, California Code of Regulations, Part 6). This section also provides for designation of the National Fenestration Rating Council (NFRC) as the supervisory entity responsible for administering the state's certification program for fenestration product U-values, provided NFRC meets specified criteria.

(a) Labeling Requirements.

- (1) **Temporary Labels.** Every fenestration product installed in new construction subject to the California Energy Code shall have attached to it a clearly visible temporary label that lists the U-value of that product and the method used to derive the U-value.
 - (A) If the product rating is taken from the Commission's default table, placing the words "CEC Default U-value," followed by the appropriate default U-value, on the temporary label meets the requirement of paragraph 1.

- (B) If the product rating is derived from the NFRC Rating Procedure, placing the words “Manufacturer stipulates that this rating was determined in accordance with NFRC 100-91” followed by the certified U-value on the temporary label meets the requirement of paragraph 1.

The “NFRC Rating Procedure” means the National Fenestration Rating Council’s NFRC 100-91: Procedure for Determining Fenestration Product Thermal Properties (currently limited to U-values) June 28, 1991, also known as “NFRC 100-91”.

- (C) The temporary label shall also certify that the product complies with section 116(a)1 of the standards.
- (2) **Permanent Labels.** If a product is rated using the NFRC Rating Procedure, it shall be permanently labeled with either a single label or series of marks on the frame, glass, and/or spacer which can be used to trace the product to a directory of certified products, published by the supervisory entity, containing the name of the manufacturer, the product type and description of relevant thermal features, the U-value rating, and the year of certification.

(b) **Certification Requirements.**

- (1) **Certification to Default U-Values.** If a product’s U-value is taken from the Commission’s default table, the U-value shall be certified by either the manufacturer or an independent certifying organization approved by the Commission.
- (A) A temporary label, affixed to the product, that contains the terms “CEC Default U-value,” followed by the appropriate U-value from the Commission’s default tables meets this requirement.
- (B) If the product claims the default U-value for a thermal-break product, the manufacturer shall also certify on the label that the product meets the thermal-break product criteria, specified on the default table, on which the default value is based. Placing the terms “Meets Thermal-Break Default Criteria” on the temporary label meets this requirement.

- (2) **Certification to NFRC Rating Procedure.** If a product's U-value is based on the NFRC Rating Procedure, the U-value may be certified only by an independent certifying organization approved by the Commission.
- (A) A temporary label, affixed to the product, that contains the terms "Manufacturer stipulates that this rating was determined in accordance with NFRC 100-91" followed by the U-value certified by the independent certifying organization meets this requirement.
 - (B) An "independent certifying organization approved by the Commission" means any organization authorized by the supervisory entity to certify U-value ratings in accordance with the NFRC Rating Procedure. If the Commission designates the NFRC as the supervisory entity, any independent certification and inspection agency (IA) licensed by NFRC, or during a start-up period, NFRC itself, shall be deemed to be an "independent certifying organization approved by the Commission."
 - (C) The "supervisory entity" means the National Fenestration Rating Council (NFRC), except as provided in paragraph (c) 1.
- (c) **Designation of Supervisory Entity.** The National Fenestration Rating Council shall be the supervisory entity to administer the certification program relating to U-values for fenestration products, provided the Commission determines that the NFRC meets the criteria in paragraph (d).
- (1) The Commission may consider designating a supervisory entity other than NFRC only if the Commission determines that the NFRC cannot meet the criteria in paragraph (d). Such other supervisory entity shall meet the criteria in paragraph (d) prior to being designated.
 - (2) The Commission shall periodically review, at least annually, the structure and operations of the supervisory entity to ensure continuing compliance with the criteria in paragraph (d).

(d) Criteria for Supervisory Entity.

- (1) Membership in the entity shall be open on a nondiscriminatory basis to any person or organization that has an interest in uniform thermal performance ratings for fenestration products, including, but not limited to, members of the fenestration industry, glazing infill industry, building industry, design professionals, specifiers, utilities, government agencies, and public interest organizations. The membership shall be composed of a broad cross section of those interested in uniform thermal performance ratings for fenestration products.
- (2) The governing body of the entity shall reflect a reasonable cross-section of the interests represented by the membership.
- (3) The entity shall maintain a program of oversight of product manufacturers, laboratories, and independent certifying organizations that ensures uniform application of the NFRC U-value Rating Procedure, labeling and certification, and such other rating procedures for other factors affecting energy performance as the NFRC and the Commission may adopt.
- (4) The entity shall require manufacturers and independent certifying organizations within its program to use only laboratories accredited by the supervisory entity to perform simulations and tests under the NFRC Rating Procedure.
- (5) The entity shall maintain appropriate guidelines for testing and simulation laboratories, manufacturers, and certifying agencies, including requirements for adequate:
 - possession and calibration of equipment;
 - education, competence, and training of personnel;
 - quality control;
 - record keeping and reporting;
 - periodic review (including, but not limited to, blind testing by laboratories; inspections of products; and inspections of laboratories, manufacturing facilities, and certifying agencies);
 - challenges to certified ratings; and

guidelines to maintain the integrity of the program, including, but not limited to, provisions to avoid conflicts of interest within the rating and certification process.

- (6) The entity shall be a nonprofit organization and shall maintain reasonable, nondiscriminatory fee schedules for the services it provides and shall make its fee schedules, the financial information on which fees are based, and financial statements available to its members for inspection.
 - (7) The entity shall provide hearing processes that give laboratories, manufacturers, and certifying agencies a fair review of decisions that adversely affect them.
 - (8) The entity shall maintain a certification policy committee whose procedures are designed to avoid conflicts of interest in deciding appeals, resolving disputes, and setting policy for the certifying organizations in its program.
 - (9) The entity shall publish at least annually a directory of products certified and decertified within its program.
 - (10) The entity itself shall be free from conflict-of-interest ties or to undue influence from any particular fenestration manufacturing interest(s), testing or simulation lab(s), or independent certifying organization(s).
 - (11) The entity shall provide or authorize the use of labels that can be used to meet the requirements of section 116(a)2, paragraphs B and C, and this section.
 - (12) The entity's certification program shall allow for multiple participants in each aspect of the program to provide for competition between manufacturers, between testing labs, between simulation labs, and between independent certifying organizations.
- (e) **Certification for Other Factors.** Nothing in this section shall preclude any entity, whether associated with a U-value certification program or not, from providing certification services relating to factors other than U-values for fenestration products.

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

Section 10-112. Criteria for Default Table U-Values.

- (a) The Commission shall maintain tables of default U-values for use as an alternative to U-values derived using the NFRC rating procedure. The default values shall meet the following criteria:
 - (1) The values shall be derived from simulations of products using the same computer simulation program(s) used in the NFRC Rating Procedure.
 - (2) The default values shall be set so that they do not provide to any significant number of products a lower U-value than those products would obtain if they were rated using the full NFRC Rating Procedure, including testing and simulation.
- (b) The Commission shall periodically review and revise the default U-values as necessary to ensure that the criteria are met.

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

EFFICIENCY STANDARDS

**CALIFORNIA CODE OF REGULATIONS
TITLE 24, PART 6**

**SUBCHAPTER 1 (SECTIONS 100 through 109):
ALL OCCUPANCIES -- GENERAL PROVISIONS**

Section 100. Scope

- (a) Buildings Covered. The provisions of Title 24, Part 6 apply to all buildings:
1. That are of occupancy type A, B, E, F, H, M, R or S; and
 2. For which an application for a building permit or renewal of an existing permit is filed (or is required by law to be filed) on or after the effective date of the provisions, or which are constructed by a governmental agency; and
 3. That are either:
 - A. Directly or indirectly conditioned by mechanical heating or mechanical cooling; or
 - B. Low-rise residential buildings that are heated with a wood heater or another non-mechanical heating system.

EXCEPTION to Section 100(a): Qualified historic buildings, as defined in the State Historic Building Code (Title 24, Part 8).

- (b) Parts of Buildings Regulated. The provisions of Title 24, Part 6 apply to the building envelope, space conditioning systems, water heating systems, and lighting systems of buildings covered by Sections 100(a).
- (c) Floors and Habitable Stories.
1. Only habitable floors that have at least 50 percent of their volume above grade as defined in the UBC shall be counted in determining how many habitable stories a building has.
 2. All conditioned space in a floor shall comply with Title 24, Part 6, whether or not the floor is above grade and whether or not it is habitable.
- (d) Sections Applicable to Particular Buildings. Table No. 1-A and this subsection list the provisions of Title 24, Part 6 that are applicable to different types of buildings covered by Section 100(a).

**TABLE NO. 1-A
APPLICATION OF STANDARDS**

Building Type	Mandatory	Performance	Prescriptive	Additions/Alterations
All Occupancies	100 through 109 and 118	---	---	---
Nonresidential, high-rise residential, and hotels/motels				
All	102, 110 through 139	141	142 through 146	149
Envelope	---	141	143	149
Mechanical	120 through 129	141	144 and 145	149
Lighting	130 through 139	141	146	149
Low-rise residential	102, 110 through 119 and 150	151(a) through (e)	151(a), (f)	152

1. All Buildings. Sections 100 through 109 and 118 apply to all buildings.
2. New Buildings.
 - A. All New Buildings. Sections 110 through 119 apply to all new buildings within the scope of Section 100(a). In addition, new buildings shall meet the requirements of B. or C., as applicable.
 - B. Nonresidential, High-Rise Residential, and Hotel/Motel Buildings that are Mechanically Heated or Mechanically Cooled.
 - i. Sections Applicable. Sections 120 through 146 apply to new nonresidential buildings, high-rise residential buildings, and hotels/motels that are mechanically heated or mechanically cooled.
 - ii. Compliance Approaches. In order to comply with Title 24, Part 6, new nonresidential buildings, high-rise residential buildings, and hotels/motels that are mechanically heated or mechanically cooled must meet the requirements of:
 - (I) Mandatory Measures: The applicable provisions of Sections 120 through 139; and
 - (II) Either:
 - Performance Approach: Section 141; or
 - Prescriptive Approach: Sections 142 through 146.
 - C. Low-Rise Residential Buildings that are Heated or Mechanically Cooled.
 - i. Sections Applicable. Sections 150 through 151 apply to new low-rise residential buildings that are heated or mechanically cooled.

ii. Compliance Approaches. In order to comply with Title 24, Part 6, new low-rise residential buildings that are heated or mechanically cooled must meet the requirements of:

(I) Mandatory Measures: The applicable provisions of Sections 110 through 119, and 150; and

(II) Either:

Performance Approach: Section 151(a) through (e);
or

Prescriptive Approach: Sections 151(a) and (f).

EXCEPTION NO. 1 to Section 100(d)2.C.(ii)(II): Seasonally occupied agricultural housing limited by state or federal agency contract to occupancy not more than 180 days in any calendar year.

EXCEPTION NO. 2 to Section 100(d)2.C.(ii)(II): Low-rise residential buildings that are heated with a wood heater or another non-mechanical heating system and that use no energy obtained from depletable sources for lighting or water heating.

3. New Construction in Existing Buildings.

A. Nonresidential, High-Rise Residential, and Hotel/Motel Buildings. Section 149 applies to new construction in existing nonresidential buildings, high-rise residential buildings, and hotels/motels.

B. Low-Rise Residential Buildings. Section 152 applies to new construction in existing low-rise residential buildings.

4. Installation of Insulation in Existing Buildings. Section 118 applies to buildings in which insulation is being installed in existing attics, or on existing water heaters or existing space conditioning ducts.

(e) Mixed Occupancy. When a building is designed and constructed for more than one type of occupancy, the space for each occupancy shall meet the provisions of Title 24, Part 6 applicable to that occupancy.

EXCEPTION to Section 100(e): If one occupancy constitutes at least 90 percent of the conditioned floor area of the building, the entire building may comply with the provisions of Title 24, Part 6 applicable to that occupancy, provided that the applicable mandatory measures in Sections 110 through 139, and 150, are met for each occupancy.

- (f) Administrative Requirements. Administrative requirements relating to permit requirements, enforcement by the Commission, locally adopted energy standards, interpretations, claims of exemption, approved calculation methods, and rights of appeal are specified in California Code of Regulations, Title 24, Part 1, Sections 10-101 to 10-112.
- (g) Certification Requirements for Manufactured Devices. Title 24, Part 6 limits the installation of the following manufactured devices to those that have been certified by their manufacturer to meet or exceed minimum specifications or efficiencies adopted by the Commission.
1. Central air-conditioning heat pumps and other central air conditioners (Section 111 and 112).
 2. Combination equipment: space heating and cooling, or space heating and water heating (Section 112(a)3.).
 3. Fenestration products (Section 116).
 4. Fluorescent lamp ballasts (Section 111).
 5. Gas space heaters (Section 111 and 112).
 6. Insulating materials (Section 118).
 7. Lighting control devices (Section 119).
 8. Oil fired storage water heaters (Section 113).
 9. Other heating and cooling equipment (Section 111 and 112).
 10. Plumbing fittings (Section 111).
 11. Pool heaters (Section 114).
 12. Refrigerators, refrigerator-freezers, and freezers (Section 111).
 13. Room air conditioners (Section 111).
 14. Slab floor perimeter insulation (Section 150(l)).
 15. Water heaters (Section 113).

The certification status of any such manufactured device may be confirmed only by reference to:

1. A directory published or approved by the Commission; or

100(g)

2. A copy of the application for certification from the manufacturer and the letter of acceptance from the Commission staff; or
3. Written confirmation from the publisher of a Commission-approved directory that a device has been certified; or
4. A Commission-approved label on the device.

NOTE to Section 100(g): Title 24, Part 6 does not require a builder, designer, owner, operator, or enforcing agency to test any certified device to determine its compliance with minimum specifications or efficiencies adopted by the Commission.

Section 101. Definitions and Rules of Construction.

(a) Rules of Construction.

1. Where the context requires, the singular includes the plural and the plural includes the singular.
2. The use of "and" in a conjunctive provision means that all elements in the provision must be complied with, or must exist to make the provision applicable. Where compliance with one or more elements suffices, or where existence of one or more elements makes the provision applicable, "or" (rather than "and/or") is used.
3. "Shall" is mandatory and "may" is permissive.

- (b) Definitions. Terms, phrases, words, and their derivatives in Title 24, Part 6 shall be defined as specified in Section 101. Terms, phrases, words, and their derivatives not found in Section 101 shall be defined as specified in Title 24, Part 2, Chapter 2 of the California Code of Regulations. Terms, phrases, words, and their derivatives not found in either Title 24, Part 6 or Chapter 2 shall be defined as specified in Title 24, Part 2, Chapter 2 of the Uniform Building Code. Where terms, phrases, words, and their derivatives are not defined in any of the references above, they shall be defined as specified in Webster's Third New International Dictionary of the English Language, Unabridged (1987 ed.), unless the context requires otherwise.

ACCA is the Air-Conditioning Contractors of America.

ACCESSIBLE is having access thereto, but which first may require removal or opening of access panels, doors, or similar obstructions.

ADDITION is any change to a building that increases conditioned floor area and conditioned volume.

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.

ALTERATION is any change to a building's water heating system, space conditioning system, lighting system, or envelope that is not an addition.

101(b)

ALTERNATIVE CALCULATION METHODS (ACMs) are the Commission's Public Domain Computer Programs, one of the Commission's Simplified Calculation Methods, or any other calculation method approved by the Commission.

ANNUAL FUEL UTILIZATION EFFICIENCY (AFUE) is a measure of the percentage of heat from the combustion of gas or oil which is transferred to the space being heated during a year, as determined using the applicable test method in the Appliance Efficiency Regulations or Section 112.

ANNUNCIATED is a visual signaling device that indicates the on, off, or other status of a load.

ANSI is the American National Standards Institute.

APPLIANCE EFFICIENCY REGULATIONS are the regulations in Title 20, Sections 1601 et. seq. of the California Code of Regulations.

APPROVED BY THE COMMISSION means approval under Section 25402.1 of the Public Resources Code.

APPROVED CALCULATION METHOD (See **ALTERNATIVE CALCULATION METHODS**).

ARI is the Air-conditioning and Refrigeration Institute.

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

ASME is the American Society of Mechanical Engineers.

ASTM is the American Society for Testing and Materials.

ATRIUM is an opening through two or more floor levels other than enclosed stairways, elevators, hoistways, escalators, plumbing, electrical, air-conditioning, or other equipment which is enclosed space and not defined as a mall.

AUTOMATIC is capable of operating without human intervention.

AUTOMATIC TIME SWITCH CONTROL DEVICES are devices capable of automatically turning loads off and on based on time schedules.

BUILDING is any structure or space for which a permit is sought.

BUILDING ENVELOPE is the ensemble of exterior and demising partitions of a building that enclose conditioned space.

CAPTIVE-KEY OVERRIDE is a type of lighting control in which the key that activates the override cannot be released when the lights are in the on position.

CERTIFYING ORGANIZATION is an independent organization recognized by the Commission to certify manufactured devices for performance values in accordance with procedures adopted by the Commission.

CLIMATE CONTROL SYSTEM (See **SPACE CONDITIONING SYSTEM**).

CLIMATE ZONES are the 16 geographic areas of California for which the Commission has established typical weather data, prescriptive packages and energy budgets. Climate zone boundary descriptions are in the document "California Climate Zone Descriptions" (July 1995), incorporated herein by reference. Figure 1-A is an approximate map of the 16 climate zones.

COEFFICIENT OF PERFORMANCE (COP), COOLING, is the ratio of the rate of net heat removal to the rate of total energy input, calculated under designated operating conditions and expressed in consistent units, as determined using the applicable test method in the Appliance Efficiency Regulations or Section 112.

COEFFICIENT OF PERFORMANCE (COP), HEATING, is the ratio of the rate of net heat output to the rate of total energy input, calculated under designated operating conditions and expressed in consistent units, as determined using the applicable test method in the Appliance Efficiency Regulations or Section 112.

COMMISSION is the California State Energy Resources Conservation and Development Commission.

CONDITIONED FLOOR AREA (CFA) is the floor area (in square feet) of enclosed conditioned space on all floors of a building, as measured at the floor level of the exterior surfaces of exterior walls enclosing the conditioned space.

CONDITIONED SPACE is space in a building that is either directly conditioned or indirectly conditioned.

CONDITIONED VOLUME is the total volume (in cubic feet) of the conditioned space within a building.

101(b)

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

COVERED PRODUCT is an appliance regulated by the efficiency standards established under the National Appliance Energy Conservation Act, 42 U.S.C. Section 6291 et seq.

CRAWL SPACE is a space immediately under the first floor of a building adjacent to grade.

CTI is the Cooling Tower Institute.

C-VALUE (also known as **C-FACTOR**) is the time rate of heat flow through unit area of a body induced by a unit temperature difference between the body surfaces, in Btu (hr. x ft.² x °F). It is not the same as K-value or K-factor.

DAYLIT AREA is the space on the floor that is the larger of (a) plus (b), or (c);

- (a) For areas daylit by vertical glazing, the daylit area has a length of 15 feet, or the distance on the floor, perpendicular to the glazing, to the nearest 60-inch or higher opaque partition, whichever is less; and a width of the window plus either 2 feet on each side, the distance to an opaque partition, or one-half the distance to the closest skylight or vertical glazing, whichever is least.
- (b) For areas daylit by horizontal glazing, the daylit area is the footprint of the skylight plus, in each of the lateral and longitudinal dimensions of the skylight, the lesser of the floor-to-ceiling height, the distance to the nearest 60-inch or higher opaque partition, or one-half the horizontal distance to the edge of the closest skylight or vertical glazing.
- (c) The daylit area calculated using a method approved by the Commission.

DECORATIVE GAS APPLIANCE is a gas appliance that is designed or installed for visual effect only, cannot burn solid wood, and simulates a fire in a fireplace.

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 are those listed in the Residential Manual. For those localities not listed in the Residential Manual the number of degree days is as determined by the applicable enforcing agency.

DEMISING PARTITIONS are barriers that separate conditioned space from enclosed unconditioned space.

DEMISING WALL is a wall that is a demising partition.

DESIGN CONDITIONS are the parameters and conditions used to determine the performance requirements of space conditioning systems. Design conditions for determining design heating and cooling loads are specified in Section 144(b) for nonresidential, high-rise residential, and hotel/motel buildings and in Section 150(h) for low-rise residential buildings.

DESIGN HEAT GAIN RATE is the total calculated heat gain through the building envelope under design conditions.

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

DIRECTLY CONDITIONED SPACE is an enclosed space that is provided with wood heating, is provided with mechanical heating that has a capacity exceeding 10 Btu/(hr·ft²), or is provided with mechanical cooling that has a capacity exceeding 5 Btu/(hr·ft²), unless the space conditioning system is designed and thermostatically controlled to maintain a process temperature less than 55°F or greater than 90°F for the whole space that the system serves.

DISPLAY LIGHTING is lighting confined to the area of a display that provides a higher level of illuminance than the level of surrounding ambient illuminance.

DISPLAY PERIMETER is the length of an exterior wall in a B-2 occupancy that immediately abuts a public sidewalk, measured at the sidewalk level for each story that abuts a public sidewalk.

DISPLAY, PUBLIC AREA are areas for the display of artwork, theme displays, and architectural surfaces in dining and other areas of public access, excluding restrooms and separate banquet rooms.

DISPLAY, SALES FEATURE is an item or items that requires special highlighting to visually attract attention and that is visually set apart from the surrounding area.

DISPLAY, SALES FEATURE FLOOR is a feature display in a retail store, wholesale store, or showroom that requires display lighting.

101(b)

DISPLAY, SALES FEATURE WALL are the wall display areas, in a retail or wholesale space, that are in the vertical plane of permanent walls or partitions, and that are open shelving feature displays or faces of internally illuminated transparent feature display cases within the Gross Sales Wall Area.

DUAL-GLAZED GREENHOUSE WINDOWS are a type of dual-glazed fenestration product which adds conditioned volume but not conditioned floor area to a building.

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

ECONOMIZER, AIR is a ducting arrangement and automatic control system that allows a cooling supply fan system to supply outside air to reduce or eliminate the need for mechanical cooling.

ECONOMIZER, WATER is a system by which the supply air of a cooling system is cooled directly or indirectly by evaporation of water, or other appropriate fluid, in order to reduce or eliminate the need for mechanical cooling.

EFFECTIVE APERTURE (EA) is (1) for windows, the visible light transmittance (VLT) times the window wall ratio; and (2) for skylights, the well factor times the VLT times the skylight area times 0.85 divided by the gross exterior roof area.

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

ENCLOSED SPACE is space that is substantially surrounded by solid surfaces.

ENERGY BUDGET is the maximum amount of source energy that a proposed building, or portion of a building, can be designed to consume, calculated with the approved procedures specified in Title 24, Part 6.

ENERGY EFFICIENCY RATIO (EER) is the ratio of net cooling capacity (in Btu/hr) to total rate of electrical energy (in watts), of a cooling system under designated operating conditions, as determined using the applicable test method in the Appliance Efficiency Regulations or Section 112.

ENERGY FACTOR (EF) is the ratio of energy output to energy consumption of a water heater, expressed in equivalent units, under designated operating conditions over a 24-hour use cycle, as determined using the applicable test method in the Appliance Efficiency Regulations.

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

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

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

ENTIRE BUILDING is the ensemble of all enclosed space in a building, including the space for which a permit is sought, plus all existing conditioned and unconditioned space within the structure.

ENVELOPE means **BUILDING ENVELOPE**.

EXFILTRATION is uncontrolled outward air leakage from inside a building, including leakage through cracks and interstices, around windows and doors, and through any other exterior partition or duct penetration.

EXPOSED THERMAL MASS is mass that is directly exposed (uncovered) to the conditioned space of the building.

EXTERIOR DOOR is an opaque door through an exterior partition.

EXTERIOR FLOOR/SOFFIT is a horizontal exterior partition, or a horizontal demising partition, under conditioned space. For low-rise residential occupancies, exterior floors also include those on grade.

EXTERIOR PARTITION is an opaque, translucent, or transparent solid barrier that separates conditioned space from ambient air or space that is not enclosed. For low-rise residential occupancies, exterior partitions also include barriers that separate conditioned space from unconditioned space, or the ground.

EXTERIOR ROOF/CEILING is an exterior partition, or a demising partition, that has a slope less than 60 degrees from horizontal, that has conditioned space below, and that is not an exterior door or skylight.

EXTERIOR ROOF/CEILING AREA is the area of the exterior surface of exterior roof/ceilings.

101(b)

EXTERIOR WALL is any wall or element of a wall, or any member or group of members, which defines the exterior boundaries or courts of a building and which has a slope of 60 degrees or greater with the horizontal plane. An exterior wall or partition is not an exterior floor/soffit, exterior door, exterior roof/ceiling, window, skylight, or demising wall.

EXTERIOR WALL AREA is the area of the opaque exterior surface of exterior walls.

FENESTRATION PRODUCT is any transparent or translucent material plus any sash, frame, mullions, and dividers, in the envelope of a building, including, but not limited to: windows, sliding glass doors, french doors, skylights, curtain walls, and garden windows.

FIREPLACE is a hearth and firechamber or similar prepared place in which a solid fuel fire may be burned, as defined in UBC Section 3102.2 and as further clarified in UBC Section 3102.7; these include but are not limited to factory-built fireplaces, masonry fireplaces, and masonry heaters.

FRAMED PARTITION or ASSEMBLY is a partition or assembly constructed using separate structural members spaced not more than 32 inches on center.

GAS HEATING SYSTEM is a natural gas or liquified petroleum gas heating system.

GAS LOG is a self-contained, free-standing, open-flame, gas-burning appliance consisting of a metal frame or base supporting simulated logs, and designed for installation only in a vented fireplace.

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. When designed for lower-than-task illuminance used in conjunction with other specific task lighting systems, it is also called "ambient" lighting.

GLAZING (See FENESTRATION PRODUCT).

GOVERNMENTAL AGENCY is any public agency or subdivision thereof, including, but not limited to, any agency of the state, a county, a city, a district, an association of governments, or a joint power agency.

GROSS EXTERIOR ROOF AREA is the sum of the skylight area and the exterior roof/ceiling area.

GROSS EXTERIOR WALL AREA is the sum of the window area, door area, and exterior wall area.

GROSS SALES FLOOR AREA is the total area (in square feet) of retail store floor space that is (1) used for the display and sale of merchandise; or (2) associated with that function, including, but not limited to, sales transactions areas, fitting rooms, and circulation areas and entry areas within the space used for display and sale.

GROSS SALES WALL AREA is the area (in square feet) of the inside of exterior walls and permanent full height interior partitions within the gross sales floor area of a retail store that is used for the presentation of merchandise for sale, less the area of openings, doors, windows, baseboards, wainscots, mechanical or structural elements, and other obstructions preventing the use of the area for the presentation of merchandise.

HABITABLE STORY is a story that contains space in which humans may work or live in reasonable comfort, and that has at least 50 percent of its volume above grade.

HEAT CAPACITY (HC) of an assembly is the amount of heat necessary to raise the temperature of all the components of a unit area in the assembly one degree F. It is calculated as the sum of the average thickness times the density times the specific heat for each component, and is expressed in Btu per square foot per degree F.

HEAT PUMP is a device that is capable of heating by refrigeration, and that may include a capability for cooling.

HEATING EQUIPMENT is equipment used to provide mechanical heating for a room or rooms in a building.

HEATING SEASONAL PERFORMANCE FACTOR (HSPF) is the total heating output of a heat pump (in British thermal units) during its normal use period for heating divided by the total electrical energy input (in watt-hours) during the same period, as determined using the applicable test method in the Appliance Efficiency Regulations.

HI is the Hydronics Institute.

HIGH-RISE RESIDENTIAL BUILDING is a building, other than a hotel/motel, of occupancy group R-1 with four or more habitable stories.

HORIZONTAL GLAZING (See SKYLIGHT).

101(b)

HOTEL/MOTEL is a building or buildings incorporating six or more guest rooms or a lobby serving six or more guest rooms, where the guest rooms are intended or designed to be used, or which are used, rented, or hired out to be occupied, or which are occupied for sleeping purposes by guests, and all conditioned spaces within the same building envelope. Hotel/motel also includes all conditioned spaces which are (1) on the same property as the hotel/motel, (2) served by the same central HVAC system as the hotel/motel, and (3) integrally related to the functioning of the hotel/motel as such, including, but not limited to, exhibition facilities, meeting and conference facilities, food service facilities, lobbies, and laundries.

HVAC SYSTEM (see **SPACE CONDITIONING SYSTEM**).

INDIRECTLY CONDITIONED SPACE is enclosed space including, but not limited to, unconditioned volume in atria, that (1) is not directly conditioned space; and (2) either (a) has an area-weighted heat transfer coefficient to directly conditioned space exceeding that to the outdoors or to unconditioned space, or (b) is a space through which air from directly conditioned spaces is transferred at a rate exceeding 3 air changes per hour.

INFILTRATION is uncontrolled inward air leakage from outside a building, or unconditioned space, including leakage through cracks and interstices, around windows and doors, and through any other exterior or demising partition or pipe or duct penetration.

INTEGRATED PART LOAD VALUE (IPLV) is a single number figure of merit based on part load EER or COP expressing part load efficiency for air-conditioning and heat pump equipment on the basis of weighted operation at various load capacities for the equipment as determined using the applicable test method in the Appliance Efficiency Regulations or Section 112.

ISOLATION DEVICE is a device that prevents the conditioning of a zone or group of zones in a building while other zones of the building are being conditioned.

LOW-RISE RESIDENTIAL BUILDING is a building, other than a hotel/motel, that is of occupancy group R-1 and is three stories or less, or that is of occupancy group R-3.

LPG is Liquefied Petroleum Gas.

LUMEN MAINTENANCE DEVICE is a device capable of automatically adjusting the light output of a lighting system throughout a continuous range to provide a preset level of illumination.

LUMINAIRE is a complete lighting unit consisting of a lamp and the parts designed to distribute the light, to position and protect the lamp, and to connect the lamp to the power supply; commonly referred to as "lighting fixtures" or "instruments."

MANUAL is capable of being operated by personal intervention.

MANUFACTURED DEVICE is any heating, cooling, ventilation, lighting, water heating, refrigeration, cooking, plumbing fitting, insulation, door, fenestration product, or any other appliance, device, equipment, or system subject to Sections 110 through 119 of Title 24, Part 6.

MECHANICAL COOLING is lowering the temperature within a space for the purpose of maintaining human comfort using refrigerant compressors or absorbers, desiccant dehumidifiers, or other systems that require energy from depletable sources. In nonresidential, high-rise residential, and hotel/motel buildings cooling of a space by direct or indirect evaporation of water alone is not considered mechanical cooling.

MECHANICAL HEATING is raising the temperature within a space for the purpose of maintaining human comfort using electric resistance heaters, fossil fuel burners, heat pumps, or other systems that require energy from depletable sources.

MODELING ASSUMPTIONS are the conditions (such as weather conditions, thermostat settings and schedules, internal gain schedules, etc.) that are used for calculating a building's annual energy consumption and that are in the Alternative Calculation Methods Manuals.

MOVABLE SHADING DEVICE (See OPERABLE SHADING DEVICE).

MULTI-SCENE DIMMING SYSTEM is a lighting control device that has the capability of setting light levels throughout a continuous range, and that has pre-established settings within the range.

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

NOTE: Requirements for high-rise residential buildings and hotels/motels are included in the nonresidential sections of Title 24, Part 6.

NONRESIDENTIAL MANUAL is the manual developed by the Commission, under Section 25402.1(e) of the Public Resources Code, to aid designers, builders and contractors in meeting the energy efficiency requirements for nonresidential, high-rise residential, and hotel/motel buildings.

101(b)

NORTH-FACING is oriented to within 45 degrees of true north, including 45°00'00" east of north (NE), but excluding 45°00'00" west of north (NW).

OCCUPANCY SENSOR, LIGHTING is a device that automatically turns lights off soon after an area is vacated.

OCCUPANCY TYPE is one of the following:

AUDITORIUM: The part of a public building where an audience sits in fixed seating, or a room, area, or building with fixed seats used for public meetings or gatherings not specifically for the viewing of dramatic performances.

BANK: A public establishment for conducting financial transactions including the custody, loan, exchange, or issue of money, for the extension of credit, and for facilitating the transmission of funds.

CLASSROOM: A room or area where classes meet.

COMMERCIAL AND INDUSTRIAL STORAGE: A room, area, or building used for storing items.

CONVENTION, CONFERENCE, OR MEETING CENTER: An assembly room, area, or building that is used for meetings, conventions and multiple purposes including, but not limited to, dramatic performances, and that has neither fixed seating nor fixed staging.

CORRIDOR: A passageway or route into which compartments or rooms open.

DINING: A room or rooms in a restaurant or hotel/motel (other than guest rooms) where meals that are served to the customers will be consumed.

EXHIBIT: A room or area that is used for exhibitions that has neither fixed seating nor fixed staging.

GENERAL COMMERCIAL AND INDUSTRIAL WORK: A room, area, or building in which an art, craft, assembly or manufacturing operation is performed.

GROCERY STORE: A room, area, or building that has as its primary purpose the sale of foodstuffs requiring additional preparation prior to consumption.

HOTEL FUNCTION AREA: A hotel room or area such as a hotel ballroom, meeting room, exhibit hall, or conference room, together with prefunction areas and other spaces ancillary to its function.

HOTEL LOBBY: The contiguous spaces in a hotel/motel between the main entrance and the front desk, including waiting and seating areas, and other spaces encompassing the activities normal to a hotel lobby function.

KITCHEN: A room or area with cooking facilities in it.

MAIN ENTRY LOBBY: The lobby of a building that is directly located by the main entrance of the building and includes the reception area, sitting areas, and public areas.

MALLS AND ARCADES: A public passageway or concourse that provides access to rows of stores or shops.

MEDICAL AND CLINICAL CARE: A room, area, or building that does not provide overnight patient care and that is used to promote the condition of being sound in body or mind through medical, dental, or psychological examination and treatment, including, but not limited to, laboratories and treatment facilities.

OFFICE: A room, area, or building of UBC group B, Division 2 occupancy other than retail and wholesale stores, fire stations, workshops, laboratories, factories, storage and warehousing facilities, educational facilities, and restaurants.

PRECISION COMMERCIAL OR INDUSTRIAL WORK: A room, area, or building in which an art, craft, assembly or manufacturing operation is performed involving visual tasks of small size or fine detail such as electronic assembly, fine woodworking, metal lathe operation, fine hand painting and finishing, egg processing operations, or tasks of similar visual difficulty.

RELIGIOUS WORSHIP: A room, area, or building for worship.

RESTAURANT: A room, area, or building that is a food establishment as defined in Section 27520 of the Health and Safety Code.

RESTROOM: A room or suite of rooms providing personal facilities such as toilets and washbasins.

RETAIL AND SALES: A room, area, or building in which the primary activity is the sale of merchandise.

101(b)

SCHOOL: A building or group of buildings that is predominately classrooms and that is used by an organization that provides instruction to students.

SUPPORT SPACE: A room or area used as a passageway, utility room, storage space, or other type of space associated with or ancillary to the function of an occupancy that is listed in these regulations.

THEATER, MOTION PICTURE: An assembly room, hall, or building with tiers of rising seats or steps for the showing of motion pictures.

THEATER, PERFORMANCE: An assembly room, hall, or building with tiers of rising seats or steps for the viewing of dramatic performances, lectures, musical events and similar live performances.

WHOLESALE SHOWROOM: A room where samples of merchandise are displayed.

OPERABLE SHADING DEVICE is a device at the interior or exterior of a building or integral with a fenestration product, which is capable of being operated, either manually or automatically, to adjust the amount of solar radiation admitted to the interior of the building.

OPTIMAL OVERHANG is an overhang that completely shades the glazing at solar noon on August 21 and substantially exposes the glass at solar noon on December 21.

ORNAMENTAL CHANDELIERS are ceiling-mounted, close-to-ceiling, or suspended decorative luminaires that use glass, crystal, ornamental metals, or other decorative material and that typically are used in hotel/motels, restaurants, or churches as a significant element in the interior architecture.

OUTDOOR AIR (Outside air) is air taken from outdoors and not previously circulated in the building.

OVERALL HEAT GAIN is the value obtained in Section 143(b)2 for determining compliance with the component envelope approach.

OVERALL HEAT LOSS is the value obtained in Section 143(b)1 for determining compliance with the component envelope approach.

POOR QUALITY LIGHTING TASKS are visual tasks that require illuminance category "E" or greater, because of the choice of a writing or printing method that produces characters that are of small size or lower contrast than good quality alternatives that are regularly used in offices.

PRIVATE OFFICE or **WORK AREA** is an office bounded by 30-inch or higher partitions and is no more than 200 square feet.

PROCESS is an activity or treatment that is not related to the space conditioning, lighting, service water heating, or ventilating of a building as it relates to human occupancy.

PROCESS LOAD is a load resulting from a process.

PUBLIC AREAS are spaces generally open to the public at large, customers, congregation members, or similar spaces, where occupants need to be prevented from controlling lights for safety, security, or business reasons.

PUBLIC FACILITY RESTROOM is a restroom designed for use by the public.

RAISED FLOOR is a floor (partition) over a crawl space, or an unconditioned space, or ambient air.

READILY ACCESSIBLE is capable of being reached quickly for operation, repair, or inspection, without requiring climbing or removing obstacles, or resorting to access equipment.

RECOOL is the cooling of air that has been previously heated by space conditioning equipment or systems serving the same building.

RECOVERED ENERGY is energy used in a building that (1) is mechanically recovered from space conditioning, service water heating, lighting, or process equipment after the energy has performed its original function; (2) provides space conditioning, service water heating, or lighting; and (3) would otherwise be wasted.

REDUCED FLICKER OPERATION is the operation of a light, in which the light has a visual flicker less than 30% for frequency and modulation.

REHEAT is the heating of air that has been previously cooled by cooling equipment or systems or an economizer.

101(b)

RELATIVE SOLAR HEAT GAIN is the ratio of solar heat gain through a fenestration product (corrected for external shading) to the solar heat gain from an unshaded single light of 1/8 inch thick clear double strength glass under the same set of conditions, excluding the effects of mullions, frames, and sashes.

REPAIR is the reconstruction or renewal of any part of an existing building for the purpose of its maintenance. Note: Repairs to low-rise residential buildings are not within the scope of these standards.

RESIDENTIAL BUILDING (See HIGH-RISE RESIDENTIAL BUILDING and LOW-RISE RESIDENTIAL BUILDING).

RESIDENTIAL MANUAL is the manual developed by the Commission, under Section 25402.1(c) of the Public Resources Code, to aid designers, builders, and contractors in meeting energy efficiency standards for low-rise residential buildings.

ROOM CAVITY RATIO (RCR) is:

(a) for rectangular rooms
$$\frac{5H (L + W)}{LW}$$

;or

(b) for irregular shaped rooms
$$\frac{2.5 H \times P}{A}$$

Where:

L = Length of room

W = Width of room

H = Vertical distance from the work plane to the center line of the lighting fixture

P = Perimeter of room

A = Area of room

RUNOUT is piping that is no more than 12 feet long and that is connected to a fixture or an individual terminal unit.

SCONCE is a wall mounted decorative light fixture.

SEASONAL ENERGY EFFICIENCY RATIO (SEER) means the total cooling output of a central air conditioner in British thermal units during its normal usage period for cooling divided by the total electrical energy input in watt-hours during the same period, as determined using the applicable test method in the Appliance Efficiency Regulations.

SERVICE WATER HEATING is heating of water for sanitary purposes for human occupancy, other than for comfort heating.

SHADING is the protection from heat gains because of direct solar radiation by permanently attached exterior devices or building elements, interior shading devices, glazing material, or adherent materials. Permanently attached means (a) attached with fasteners that require additional tools to remove (as opposed to clips, hooks, latches, snaps, or ties); or (b) required by the UBC for emergency egress to be removable from the interior without the use of tools.

SHADING COEFFICIENT (SC) is the ratio of the solar heat gain through a fenestration product to the solar heat gain through an unshaded 1/8 inch thick clear double strength glass under the same set of conditions. For nonresidential, high-rise residential, and hotel/motel buildings, this shall exclude the effects of mullions, frames, sashes, and interior and exterior shading devices.

SITE SOLAR ENERGY is natural daylighting, or thermal, chemical, or electrical energy derived from direct conversion of incident solar radiation at the building site.

SKYLIGHT is glazing having a slope less than 60 degrees from the horizontal with conditioned space below, except for purposes of complying with Section 151(f), where a skylight is glazing having a slope not exceeding 4.76 degrees (1:12) from the horizontal.

SKYLIGHT AREA is the area of the surface of a skylight, plus the area of the frame, sash, and mullions.

SOURCE ENERGY is the energy that is used at a site and consumed in producing and in delivering energy to a site, including, but not limited to, power generation, transmission, and distribution losses, and that is used to perform a specific function, such as space conditioning, lighting or water heating. Table 1-B contains the conversion factors for converting site to source energy.

SOUTH-FACING is oriented to within 45 degrees of true south including 45°00'00" west of south (SW), but excluding 45°00'00" east of south (SE).

SPA is a vessel that contains heated water, in which humans can immerse themselves, is not a pool, and is not a bathtub.

SPACE CONDITIONING SYSTEM is a system that provides either collectively or individually heating, ventilating, or cooling within or associated with conditioned spaces in a building.

101(b)

SMACNA is the Sheet Metal and Air-conditioning Contractors National Association.

SYSTEM is a combination of equipment, controls, accessories, interconnecting means, or terminal elements, by which energy is transformed to perform a specific function, such as space conditioning, service water heating, or lighting.

TASK-ORIENTED LIGHTING is lighting that is designed specifically to illuminate a task location, and that is generally confined to the task location.

THERMAL MASS is solid or liquid material used to store heat for later heating use or for reducing cooling requirements.

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

THROW DISTANCE is the distance between the luminaire and the center of the plane lit by the luminaire on a display.

TUNING is a lighting control device that allows authorized personnel only to select a single light level within a continuous range.

UBC is the 1994 edition of the state-adopted Uniform Building Code, Title 24.

UL is the Underwriters Laboratory.

UMC is the 1994 edition of the state-adopted Uniform Mechanical Code.

UNCONDITIONED SPACE is enclosed space within a building that is not conditioned space.

UNIT INTERIOR MASS CAPACITY (UIMC) is the amount of effective heat capacity per unit of thermal mass, taking into account the type of mass material, thickness, specific heat, density and surface area.

U-VALUE is the overall coefficient of thermal transmittance of a construction assembly, in $\text{Btu}/(\text{hr} \times \text{ft}^2 \times ^\circ\text{F})$, including air film resistance at both surfaces.

VAPOR BARRIER is a material that has a permeance of one perm or less and that provides resistance to the transmission of water vapor.

VARIABLE AIR VOLUME (VAV) SYSTEM is a space conditioning system that maintains comfort levels by varying the volume of conditioned air to the zones served.

VERY VALUABLE MERCHANDISE is rare or precious objects, including, but not limited to, jewelry, coins, small art objects, crystal, china, ceramics, or silver, the selling of which involves customer inspection of very fine detail from outside of a locked case.

VISIBLE LIGHT TRANSMITTANCE (VLT) is the ratio (expressed as a decimal) of visible light that is transmitted through a glazing material to the light that strikes the material.

WELL FACTOR is the ratio of the amount of visible light leaving a skylight well to the amount of visible light entering the skylight well and is calculated as follows:

(a) for rectangular wells:

$$\left(\frac{\text{Well height (well length + well width)}}{2 \times \text{well length} \times \text{well width}} \right)$$

; or

(b) for irregular shaped wells:

$$\left(\frac{\text{Well height} \times \text{well perimeter}}{4 \times \text{well area}} \right)$$

Where the length, width, perimeter, and area are measured at the bottom of the well, and R is the weighted average reflectance of the walls of the well.

WEST-FACING is oriented to within 45 degrees of true west, including 45°00'00" north of due west (NW), but excluding 45°00'00" south of west (SW).

WINDOW is glazing that is not a skylight.

WINDOW AREA is the area of the surface of a window, plus the area of the frame, sash, and mullions.

WINDOW WALL RATIO is the ratio of the window area to the gross exterior wall area.

WOOD HEATER is an enclosed wood burning appliance used for space heating and/or domestic water heating, and which meets the definition in Federal Register, Volume 52, Number 32, February 18, 1987.

101(b)

WOOD STOVE (See WOOD HEATER).

ZONE, LIGHTING is a space or group of spaces within a building that has sufficiently similar requirements so that lighting can be automatically controlled in unison throughout the zone by an illumination controlling device or devices, and does not exceed one floor.

ZONE, SPACE CONDITIONING is a space or group of spaces within a building with sufficiently similar comfort conditioning requirements so that comfort conditions, as specified in 144(b)3 or 150(h), as applicable, can be maintained throughout the zone by a single controlling device.

Section 102. Calculation of Source Energy Consumption.

When calculating source energy consumption, consumption of electricity, natural gas, fuel oil, and LPG shall be converted to Btus at the rates shown in Table No. 1-B.

**TABLE NO. 1-B
SOURCE ENERGY CONVERSION RATES**

<u>Energy Source</u>	<u>Btu per unit consumption</u>
Electricity	10,239 Btu/kilowatt-hour
Natural Gas	100,000 Btu/therm
Fuel Oil	138,400 Btu/gallon
LPG	91,080 Btu/gallon

Section 103. [Reserved]

Section 104. [Reserved]

Section 105. [Reserved]

Section 106. [Reserved]

Section 107. [Reserved]

Section 108. [Reserved]

Section 109. [Reserved]

**SUBCHAPTER 2 (SECTIONS 110 through 119):
ALL OCCUPANCIES -- MANDATORY REQUIREMENTS FOR THE
MANUFACTURE, CONSTRUCTION, AND INSTALLATION OF SYSTEMS,
EQUIPMENT, AND BUILDING COMPONENTS.**

Section 110. Systems and Equipment -- General.

Sections 111 through 119 establish requirements for the manufacture, construction, and installation of certain systems, equipment, and building components that are installed in buildings regulated by Title 24, Part 6. Systems, equipment, and building components listed below may be installed only if:

- (a) The manufacturer has certified that the system, equipment, or building component complies with the applicable manufacture provisions of Sections 111 through 119; and
- (b) The system, equipment, or building component complies with the applicable installation provisions of Sections 111 through 119.

No system, equipment, or building component covered by the provisions of Section 111 through Section 119 that is not certified or that fails to comply with the applicable installation requirements may be installed in a building regulated by Title 24, Part 6.

The systems, equipment, and building components covered are:

Appliances regulated by the Appliance Efficiency Regulations. (Section 111)
Other space conditioning equipment. (Section 112)
Other service water heating systems and equipment. (Section 113)
Pool and spa heating systems and equipment. (Section 114)
Gas appliances. (Section 115)
Doors, windows, and fenestration products. (Section 116)
Joints and other openings. (Section 117)
Insulation. (Section 118)
Lighting control devices. (Section 119)

Section 111. Mandatory Requirements for Appliances Regulated by the Appliance Efficiency Regulations.

Any appliance for which there is a California standard established in the Appliance Efficiency Regulations may be installed only if the manufacturer has certified to the Commission, as specified in those regulations, that the appliance complies with the applicable standard for that appliance. See Appendix 1-A for availability of directories of certified appliances.

Section 112. Mandatory Requirements for Space Conditioning Equipment.

Certification by Manufacturers. Any space conditioning equipment listed in this section may be installed only if the manufacturer has certified that the equipment complies with all the applicable requirements of this section.

- (a) Efficiency. Equipment shall meet the applicable requirements of Table No. 1-C, subject to the following:
1. If more than one standard is listed in Table No. 1-C, the equipment shall meet all the standards listed; and
 2. If more than one test method is listed in Table No. 1-C, the equipment shall comply with the applicable standard when tested with each test method; and
 3. Where equipment can serve more than one function, such as both heating and cooling, or both space heating and water heating, it shall comply with all the requirements applicable to each function; and
 4. Where a requirement is for equipment rated at its "maximum rated capacity" or "minimum rated capacity," the capacity shall be as provided for and allowed by the controls, during steady state operation.

**TABLE NO. 1-C
EFFICIENCY REQUIREMENTS FOR SPACE CONDITIONING EQUIPMENT**

UNITARY AIR CONDITIONERS AND HEAT PUMPS, ELECTRICALLY OPERATED, $\geq 135,000$ BTU/HR

<u>Equipment Type</u>	<u>Size Category</u>	<u>Sub-Category or Rating Condition</u>	<u>Efficiency Requirement</u>	<u>When Tested With</u>
Air Conditioners, Air Cooled	$\geq 135,000$ BTU/HR	--	8.5 EER	ARI 360-86
	$< 760,000$ BTU/HR		7.5 IPLV	
	$\geq 760,000$ BTU/HR	--	8.2 EER 7.5 IPLV	ARI 360-86
Air Conditioners, Water or Evaporatively Cooled	$\geq 135,000$ BTU/HR	--	9.6 EER 9.0 IPLV	ARI 360-86 CTI 201(86)
Heat Pumps, Air Cooled, Cooling Mode	$\geq 135,000$ BTU/HR	--	8.5 EER	ARI 340-86
	$< 760,000$ BTU/HR		7.5 IPLV	
	$\geq 760,000$ BTU/HR	--	8.2 EER 7.5 IPLV	ARI 340-86
Heat Pumps, Air Cooled, Heating Mode	$\geq 135,000$ BTU/HR	47 °F 17 °F	2.9 COP 2.0 COP	ARI 340-86
Condensing Units, Air Cooled	$\geq 135,000$ BTU/HR	--	9.9 EER 11.0 IPLV	ARI 365-87
Condensing Units, Water or Evaporatively Cooled	$\geq 135,000$ BTU/HR	--	12.9 EER 12.9 IPLV	ARI 365-87 CTI 201(86)

WATER CHILLING PACKAGES, WATER AND AIR COOLED, ELECTRICALLY OPERATED

<u>Equipment Type</u>	<u>Size Category</u>	<u>Sub-Category or Rating Condition</u>	<u>Efficiency Requirement</u>	<u>When Tested With</u>
Water Cooled	< 150 Tons	--	3.8 COP 3.9 IPLV	CTI 201(86) ARI 550-90 ARI 590-90
		--	4.2 COP 4.5 IPLV	CTI 201(86) ARI 550-90 ARI 590-90
	≥ 150 < 300 Tons	--	4.2 COP 4.5 IPLV	CTI 201(86) ARI 550-90 ARI 590-90
		--	4.2 COP 4.5 IPLV	CTI 201(86) ARI 550-90 ARI 590-90
≥ 300 Tons	with CFC Refrigerants with ozone depletion factors greater than those for R-22	5.2 COP 5.3 IPLV	CTI 201(86) ARI 550-90 ARI 590-90	
	all others	4.7 COP 4.8 IPLV	CTI 201(86) ARI 550-90 ARI 590-90	
Air Cooled	< 150 Tons	with condenser	2.7 COP 2.8 IPLV	ARI 550-90 ARI 590-90
		with condenser	2.5 COP 2.5 IPLV	ARI 550-90 ARI 590-90
	≥ 150 Tons	with condenser	2.5 COP 2.5 IPLV	ARI 550-90 ARI 590-90
All sizes	without condenser	3.1 COP 3.2 IPLV	ARI 550-90 ARI 590-90	

BOILERS

<u>Equipment Type</u>	<u>Size Category</u>	<u>Sub-Category or Rating Condition</u>	<u>Efficiency Requirement</u>	<u>When Tested With</u>
Gas-Fired	$\geq 300,000$ Btu/hour	At both maximum and minimum rated capacity	80% Combustion Efficiency	ANSI Z21.13-87 HI Heating Boiler Standard 86 ASME PTC 4.1-64 UL 795-73
Oil-Fired	$\geq 225,000 < 300,000$ Btu/hour		80% AFUE	10 CFR Part 430, Appendix N
	$\geq 300,000$ Btu/hour	At both maximum and minimum rated capacity	83% Combustion Efficiency	HI Heating Boiler Standard 86 ASME PTC 4.1-64 UL 726-75
Oil-Fired (Residual)	$\geq 300,000$ Btu/hour	At both maximum and minimum rated capacity	83% Combustion Efficiency	HI Heating Boiler Standard 86 ASME PTC 4.1-64

WARM AIR FURNACES AND COMBINATION WARM AIR FURNACES/AIR-CONDITIONING UNITS

<u>Equipment Type</u>	<u>Size Category</u>	<u>Sub-Category or Rating Condition</u>	<u>Efficiency Requirement</u>	<u>When Tested With</u>
Gas-Fired	≥225,000 Btu/hour	At maximum rated capacity	80% Thermal Efficiency	ANSI Z21.47-83
		At minimum rated capacity	78% Thermal Efficiency	ANSI Z21.47-83
Oil-Fired	≥225,000 Btu/hour	At both maximum and minimum rated capacity	81% Thermal Efficiency	U.L. 727-86

UNIT HEATERS

<u>Equipment Type</u>	<u>Size Category</u>	<u>Sub-Category or Rating Condition</u>	<u>Efficiency Requirement</u>	<u>When Tested With</u>
Oil-Fired	All sizes	At maximum rated capacity	81% Thermal Efficiency	U.L.731-88
		At minimum rated capacity	81% Thermal Efficiency	U.L.731-88

112(b)

(b) Controls for Heat Pumps with Supplementary Electric Resistance Heaters. Heat pumps with supplementary electric resistance heaters shall have controls:

1. That prevent supplementary heater operation when the heating load can be met by the heat pump alone; and
2. In which the cut-on temperature for compression heating is higher than the cut-on temperature for supplementary heating, and the cut-off temperature for compression heating is higher than the cut-off temperature for supplementary heating.

EXCEPTION to Section 112(b): The controls may allow supplementary heater operation during:

- I. Defrost; and
- II. Transient periods such as start-ups and following room thermostat setpoint advance, if the controls provide preferential rate control, intelligent recovery, staging, ramping, or another control mechanism designed to preclude the unnecessary operation of supplementary heating.

Section 113. Mandatory Requirements for Service Water Heating Systems and Equipment.

- (a) Certification by Manufacturers. Any service water heating system or equipment may be installed only if the manufacturer has certified that the system or equipment complies with all of the requirements of this subsection for that system or equipment.
1. Temperature Controls for Service Water Heating Systems. Service water heating systems shall be equipped with automatic temperature controls capable of adjustment from the lowest to the highest acceptable temperature settings for the intended use as listed in Table 3, Chapter 54 of the 1987 ASHRAE Handbook, HVAC Systems & Applications Volume.

EXCEPTION to Section 113(a)1.: Residential occupancies.

- (b) Installation. Any service water heating system or equipment may be installed only if the system or equipment complies with all of the applicable requirements of this subsection for the system or equipment.
1. Outlet Temperature Controls. On systems that have a total capacity greater than 167,000 Btu/hr, outlets that require higher than service water temperatures as listed in the 1987 ASHRAE Handbook, HVAC Systems & Applications Volume, shall have separate remote heaters, heat exchangers, or boosters to supply the outlet with the higher temperature.
 2. Pumps for Circulating Systems. Circulating service water heating systems shall have a control capable of automatically turning off the circulating pump when hot water is not required.

EXCEPTION to Section 113(b)2.: Residential occupancies.

3. Flow Rate and Temperature Controls for Public Lavatories. Lavatories in public restrooms of public facilities shall have controls that comply with A, B, and C (for self-closing valves):
 - A. The controls shall limit the flow rate of hot water to:
 - i. 0.50 gpm; or

113(b)3.-5.

- ii. 0.75 gpm, if the control is a foot switch, occupancy sensor, or other device that limits the period of water discharge; or
 - iii. 2.5 gpm, if the control is a self-closing valve.
 - B. The controls shall limit the outlet temperature to 110°F.
 - C. For self-closing valves, the controls shall limit the hot water delivered per cycle of use to:
 - i. 0.25 gallons per cycle, if the control is on a circulating system; or
 - ii. 0.50 gallons per cycle, if the control is on a non-circulating system; or
 - iii. 0.75 gallons per cycle, if the control is a foot switch, occupancy sensor, or other device that limits the period of water discharge.
- 4. Insulation. Unfired service water heater storage tanks and backup tanks for solar water heating systems shall have:
 - A. External insulation with an installed R-value of at least R-12; or
 - B. Internal and external insulation with a combined R-value of at least R-16; or
 - C. The heat loss of the tank surface based on an 80 degree F. water-air temperature difference shall be less than 6.5 Btus per hour per square foot.
- 5. Service Water Heaters in State Buildings. Any new building constructed by the State shall derive its service water heating from a system that provides at least 60% of the energy needed for service water heating from site solar energy or recovered energy.

EXCEPTION to Section 113(b)5.: Buildings for which the State Architect determines that service water heating from site solar energy or recovered energy is economically or physically infeasible.

114(a)-(b)2.

Section 114. Mandatory Requirements for Pool and Spa Heating Systems and Equipment.

(a) Certification by Manufacturers. Any pool or spa heating system or equipment may be installed only if the manufacturer has certified that the system or equipment has all of the following:

1. Efficiency. A thermal efficiency for gas-fired systems of at least 78%, when tested according to ANSI Standard Z21.56-1986; and
2. On-Off Switch. A readily accessible on-off switch, mounted on the outside of the heater, that allows shutting off the heater without adjusting the thermostat setting; and
3. Instructions. A permanent, easily readable, and weatherproof plate or card that gives instruction for the energy efficient operation of the pool or spa and for the proper care of pool or spa water when a cover is used; and
4. Electric Resistance Heating. No electric resistance heating; and

EXCEPTION No. 1 to Section 114(a)4.: Listed package units with fully insulated enclosures, and with tight-fitting covers that are insulated to at least R-6.

EXCEPTION No. 2 to Section 114(a)4.: Pools or spas deriving at least 60% of the annual heating energy from site solar energy or recovered energy.

5. Pilot Light. No pilot light.

(b) Installation. Any pool or spa heating system or equipment shall be installed with all of the following:

1. Piping. At least 36" of pipe between the filter and the heater, to allow for the future addition of solar heating equipment; and
2. Covers. A cover for outdoor pools or outdoor spas; and

EXCEPTION to Section 114(b)2.: Pools or spas deriving at least 60% of the annual heating energy from site solar energy or recovered energy.

3. Directional Inlets and Time Switches for Pools. If the system or equipment is for a pool:

- A. The pool shall have directional inlets that adequately mix the pool water; and
- B. The circulation pump shall have a time switch that allows the pump to be set to run in the off-peak electric demand period, and for the minimum time necessary to maintain the water in the condition required by applicable public health standards.

EXCEPTION to Section 114(b)3.B.: Where applicable public health standards require on-peak operation.

Section 115. Natural Gas Central Furnaces, Cooking Equipment, and Pool and Spa Heaters: Pilot Lights Prohibited.

Any natural gas system or equipment listed below may be installed only if it does not have a continuously burning pilot light:

- (a) Fan type central furnaces.
- (b) Household cooking appliances.

EXCEPTION to Section 115(b): Household cooking appliances without an electrical supply voltage connection and in which each pilot consumes less than 150 Btu/hr.

- (c) Pool heaters.
- (d) Spa heaters.

Section 116. Mandatory Requirements for Exterior Doors, Windows, and Fenestration Products.

(a) Certification of Manufactured Exterior Doors and Windows and Manufactured Fenestration Products. Any manufactured doors or windows or manufactured fenestration product may be installed only if the manufacturer has certified to the Commission, or if an independent certifying organization approved by the Commission has certified, that the product complies with all of the applicable requirements of this subsection.

1. Manufactured Doors and Windows. Manufactured doors and windows shall have air infiltration rates not exceeding those shown in Table No. 1-E, when tested according to ASTM E283-91 at a pressure differential of 75 pascals or 1.57 pounds/ft².

**TABLE NO. 1-E
MAXIMUM AIR INFILTRATION RATES**

	WINDOWS (cfm/ft of operable sash crack)	RESIDENTIAL DOORS (cfm/ft ² of door area)	ALL OTHER DOORS (cfm/ft ² of door area)	
Type	all	swinging, sliding	sliding, swinging (single door)	swinging (double door)
Rate	0.37	0.37	0.37	1.0

2. Manufactured Fenestration Products. Manufactured fenestration products shall:

A. Be certified as to their overall U-values as rated in accordance with the National Fenestration Rating Council's NFRC-100-91 (June 28, 1991), incorporated herein by reference or in accordance with a default table method approved by the Commission; and

B. Have a temporary label, not to be removed before inspection by the enforcement agency, listing the certified U-value and certifying that the requirements of Section 116(a)1. are met; and

116(a)2. - 116(b)

- C. Have a permanent label listing the U-value, certifying organization, and rating procedures or a label to allow tracking back to the original certification information on file with the certifying organization.

- (b) Installation of Site Constructed Doors, Skylights, and Windows. Site constructed doors, skylights, and windows, including, but not limited to, field manufactured doors, skylights, and windows, shall be caulked between the door, skylights, or window and the building, and shall be weatherstripped.

EXCEPTION to Section 116(b): Unframed glass doors and fire doors.

Section 117. Mandatory Requirements for Joints and Other Openings.

- (a) Joints and other openings in the building envelope that are potential sources of air leakage shall be caulked, gasketed, weatherstripped, or otherwise sealed to limit infiltration and exfiltration.

Section 118. Mandatory Requirements for Insulation.

- (a) Certification by Manufacturers. Any insulation of the type and form listed below may be installed only if the manufacturer has certified that the insulation complies with the California Quality Standards for Insulating Material, Title 20, Chapter 4, Article 3. See Appendix 1-A for availability of directories of certified insulating material.

<u>Type</u>	<u>Form</u>
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
Phenolic	board form
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

- (b) Installation of Urea Formaldehyde Foam Insulation. Urea formaldehyde foam insulation may be applied or installed only if:
1. It is installed in exterior sidewalls; and
 2. A four mil thick plastic polyethylene vapor barrier or equivalent plastic sheeting vapor barrier is installed between the urea formaldehyde foam insulation and the interior space in all applications.
- (c) Flamespread rating. All insulating material shall be installed in compliance with the flamespread rating and smoke density requirements of Sections 2602 and 707 of the Title 24, Part 2.
- (d) Installation of Insulation in Existing Buildings. Insulation installed in an existing attic, or on an existing duct or water heater, shall comply with the applicable requirements of this subsection. If a contractor installs the insulation, the contractor shall certify to the customer, in writing, that the insulation meets the applicable requirements of this subsection.

1. Attics. If insulation is installed in the existing attic of a low-rise residential building, the R-value of the total amount of insulation (after addition of insulation to the amount, if any, already in the attic) shall be at least R-30, if the building is located in an area that has less than 5,000 heating degree days, or R-38 if the building is located in an area that has 5,000 heating degree days or more.

EXCEPTION to Section 118(d)1.: Where the accessible space in the attic is not large enough to accommodate the required R-value, the entire accessible space shall be filled with insulation provided such installation does not violate Section 1505.3 of Title 24, Part 2.

2. Water Heaters. If external insulation is installed on an existing unfired water storage tank or on an existing back up tank for a solar water heating systems, it shall have an R-value of at least R-12, or the heat loss of the tank surface based on an 80°F water-air temperature difference shall be less than 6.5 Btus per hour per square foot.
3. Ducts. If insulation is installed on an existing space conditioning duct, it shall comply with Section 604 of the UMC.

- (e) Demising Walls in Nonresidential Buildings. The opaque portions of framed demising walls in nonresidential buildings shall have insulation with an installed R-value of no less than R-11 between framing members.

119(a)-(d)1.

Section 119. Mandatory Requirements for Lighting Control Devices.

Any automatic time switch control device, occupant-sensing device, automatic daylighting control device, lumen maintenance control device, or interior photocell sensor device may be installed only if the manufacturer has certified to the Commission, that the device complies with all of the applicable requirements of subsections (a)-(g), and if the device is installed in compliance with subsection (h).

- (a) All Devices: Instructions for Installation and Calibration. The manufacturer shall provide step-by-step instructions for installation and start-up calibration of the device.
- (b) All Devices: Status Signal. The device shall have an indicator that visibly or audibly informs the device operator that it is operating properly, or that it has failed or malfunctioned.

EXCEPTION to Section 119(b): Photocell sensors or other devices where a status signal is infeasible because of inadequate power.

- (c) Automatic Time Switch Control Devices. Automatic time switch control devices shall:
 - 1. Be capable of programming different schedules for weekdays and weekends; and
 - 2. Have program backup capabilities that prevent the loss of the device's program and time setting for at least 10 hours if power is interrupted.
- (d) Occupant-Sensing Devices. Occupant-sensing devices shall be capable of automatically turning off all the lights in an area no more than 30 minutes after the area has been vacated. In addition, ultrasonic and microwave devices shall have a built-in mechanism that allows calibration of the sensitivity of the device to room movement, in order to reduce the false sensing of occupants, and shall comply with either 1. or 2., as applicable:
 - 1. If the device emits ultrasonic radiation as a signal for sensing occupants within an area, the device shall:

- A. Have had an Initial Report submitted to the Bureau of Radiological Health, Federal Food and Drug Administration, under 21 Code of Federal Regulations, Section 1002.10 (1990), and a copy of the report shall have been submitted to the California Energy Commission; and
- B. Emit no audible sound; and
- C. Not emit ultrasound in excess of the following decibel (dB) values, measured no more than five feet from the source, on axis:

Midfrequency of Sound Pressure Third-Octave Band (in kHz)	Maximum dB Level Within Third Octave Band (in dB reference 20 micropascals)
less than 20	80
20 or more to less than 25	105
25 or more to less than 31.5	110
31.5 or more	115

- 2. If the device emits microwave radiation as a signal for sensing occupants within area, the device shall:
 - A. Comply with all applicable provisions in 47 Code of Federal Regulations, Part 5 (1989), and have an approved Federal Communications Commission identification number that appears on all units of the device and that has been submitted to the Commission; and
 - B. Not emit radiation in excess of one (1) milliwatt per square centimeter measured at no more than five (5) centimeters from the emission surface of the device; and
 - C. Have permanently affixed to it installation instructions recommending that it be installed at least twelve (12) inches from any area normally used by room occupants.

119(e)-(g)

- (e) Automatic Daylighting Control Devices. Automatic daylighting control devices shall:
1. Be capable of reducing the light output of the general lighting of the controlled area by at least one-half while maintaining a uniform level of illuminance throughout the area; and
 2. If the device is a dimmer, provide electrical outputs to lamps for reduced flicker operation through the dimming range and without causing premature lamp failure; and
 3. If the device is a stepped dimming system, incorporate time delay circuits to prevent cycling of light level changes of less than three minutes; and
 4. If the device uses step switching with separate "on" and "off" settings for the steps, have sufficient separation (deadband) of "on" and "off" points to prevent cycling; and
 5. Have provided by the manufacturer step-by-step instructions for installation and start-up calibration to design footcandle levels.
- (f) Lumen Maintenance Control Devices. Lumen maintenance control devices shall:
1. Be capable of reducing the light output of the general lighting of the controlled area by at least 30% while maintaining a uniform illuminance throughout the area; and
 2. Provide electrical outputs to lamps for reduced flicker operation through the dimming range and without causing premature lamp failure; and
 3. Incorporate an alarm, either audible or visible, to announce when a specified setpoint has been reached; and
 4. Have provided by the manufacturer step-by-step instructions for installation and start up calibration to design footcandle levels.
- (g) Interior Photocell Sensor Devices. Interior photocell sensors shall not have a mechanical slide cover or other device that permits easy unauthorized disabling of the control, and shall not be incorporated into a wall-mounted occupant-sensing device.

- (h) Installation in Accordance with Manufacturer's Instructions. If an automatic time switch control device, occupant-sensing device, automatic daylighting control device, lumen maintenance control device, or interior photocell sensor device is installed, it shall comply with both 1. and 2.
1. The device shall be installed in accordance with the manufacturer's instructions; and
 2. Automatic daylighting control devices and lumen maintenance control devices shall:
 - A. Be installed so that automatic daylighting control devices control only luminaires within the daylit area; and
 - B. Have photocell sensors that are either ceiling mounted or located so that they are accessible only to authorized personnel, and that are located so that they maintain adequate illumination in the area according to the designer's or manufacturer's instructions.

**SUBCHAPTER 3 (SECTIONS 120 through 129):
NONRESIDENTIAL, HIGH-RISE RESIDENTIAL, AND HOTEL/MOTEL
OCCUPANCIES -- MANDATORY REQUIREMENTS FOR SPACE
CONDITIONING AND SERVICE WATER HEATING SYSTEMS AND
EQUIPMENT.**

**Section 120. Space Conditioning and Service Water Heating Systems and Equipment
-- General.**

Sections 121 through 129 establish requirements for the design and installation of space conditioning and service water heating systems and equipment in nonresidential, high-rise residential, and hotel/motel buildings subject to Title 24, Part 6. All such buildings shall comply with the applicable provisions of Sections 121 through Section 129.

Section 121. Requirements for Ventilation.**(a) General Requirements.**

1. All enclosed spaces in a building that are normally used by humans shall be ventilated in accordance with the requirements of this section.

NOTE: In addition to meeting the requirements of this section, for those occupancies where unusual contaminants are present or anticipated (such as commercial dry cleaners, coin-operated dry cleaners, bars and cocktail lounges, auto repair workshops, smoking lounges, barber shops, beauty shops), it is recommended to use local exhaust ventilation and enclosure to capture the contaminants and discharge them directly outdoors.

2. The outdoor air ventilation rate and air distribution assumptions made in the design of the ventilating system shall be clearly identified on the plans required by Section 10-103 of Title 24, Part 1.

(b) Design Requirements for Minimum Quantities of Outdoor Air. Every space in a building shall be designed to have outdoor air ventilation according to 1. or 2.:

1. Natural Ventilation. Natural ventilation may be provided for spaces that:
 - A. Are within 20 feet of an operable wall or roof opening through which outdoor air flows, which has an openable area more than 5% of the conditioned floor area of the space, and which is readily accessible to occupants of the space at all times when the space is occupied; and
 - B. Have a direct outdoor air flow from the operable wall or roof opening, unobstructed by walls or doors.
2. Mechanical Ventilation. Each space that is not naturally ventilated under 1. shall be ventilated with a mechanical system capable of providing an outdoor air rate no less than the larger of:
 - A. The conditioned floor area of the space, times the applicable ventilation rate from Table No. 1-F; or

121(b)2.

- B. 15 cfm per person, times the expected number of occupants. For spaces without fixed seating, the expected number of occupants shall be assumed to be no less than one-half the maximum occupant load assumed for exiting purposes in Chapter 10 of the UBC. For spaces with fixed seating, the expected number of occupants shall be determined in accordance with Chapter 10 of the UBC.

EXCEPTION to Section 121(b)2.: Transfer Air. The rate of outdoor air required by Section 121(b)2. may be provided with air transferred from other ventilated spaces, if:

- I. None of the spaces from which air is transferred have any unusual sources of indoor air contaminants; and
- II. Enough outdoor air is supplied to all spaces combined to meet the requirements of Section 121(b)2. for each space individually.

**TABLE NO. 1-F
MINIMUM VENTILATION RATES**

<u>Type of Use</u>	<u>Cfm per Square Foot Of Conditioned Floor Area</u>
Auto Repair Workshops	1.50
Barber Shops	0.40
Bars, Cocktail Lounges, and Casinos	1.50
Beauty Shops	0.40
Coin-Operated Dry Cleaning	0.30
Commercial Dry Cleaning	0.45
High-Rise Residential	Per UBC Section 1203
Hotel Guest Rooms (less than 500 sq. ft.)	30 CFM/Guest Room
Hotel Guest Rooms (500 sq. ft. or greater)	0.15
Retail Stores	0.20
Smoking Lounges	1.50
All Others	0.15

121(c)-(d)2.

(c) Operation and Control Requirements for Minimum Quantities of Outdoor Air.

1. Times of Occupancy. The minimum rate of outdoor air required by Section 121(b)2. shall be supplied to each space at all times when the space is usually occupied.

EXCEPTION No. 1 to Section 121(c)1.: Demand Control Ventilation. The rate of outdoor air provided to an intermittently occupied space may be reduced to 0.15 cfm per square foot of conditioned floor area, if the ventilation system serving the space is controlled by a demand control ventilation device approved by the Commission and:

- I. If the device is a CO₂ sensor it limits the CO₂ level to no more than 800 ppm while the space is occupied; and
- II. The sensor for the device is located (1) in the space; or (2) in a return air stream from the space with no less than one sensor for every 25,000 square feet of habitable space, or no more space than is recommended by the manufacturer, whichever is less.

EXCEPTION No. 2 to Section 121(c)1.: Temporary Reduction. The rate of outdoor air provided to a space may be reduced below the level required by Section 121(b)2. for up to 5 minutes each hour if the average rate each hour is the required rate.

2. Pre-Occupancy. The minimum rate of outdoor air required by Section 121(b)2., or three complete air changes, whichever is less, shall be supplied to the entire building during the one-hour period immediately before the building is normally occupied.

(d) Ducting for Zonal Heating and Cooling Units. Where a return plenum is used to distribute outdoor air to a zonal heating or cooling unit which then supplies the air to a space in order to meet the requirements of Section 121(b)2., the outdoor air shall be ducted to discharge either:

1. Within 5 feet of the unit; or
2. Within 15 feet of the unit, substantially toward the unit, and at a velocity not less than 500 feet per minute.

- (e) Design and Control Requirements for Quantities of Outdoor Air. All mechanical ventilation and space conditioning systems shall be designed with and have installed duct work, dampers, and controls to allow outside air rates to be operated at the larger of (1) the minimum levels specified in Section 121(b)2.; or (2) the rate required for make-up of exhaust systems that are required for a process, for control of odors, or for the removal of contaminants within the space.
- (f) Completion and Balancing. Before an occupancy permit is granted for a new building or space, or a new space conditioning or ventilating system serving a building or space is operated for normal use, all ventilation systems serving the building or space shall be documented in accordance with Title 8, Section 5142(b) of the California Safety Code (1987) to be providing the minimum ventilation rate specified in Section 121(b)2., as determined using one of the following procedures:
1. **Balancing.** The system shall be balanced in accordance with the National Environmental Balancing Bureau (NEBB) Procedural Standards (1983) or Associated Air Balance Council (AABC) National Standards (1986); or
 2. **Outside Air Certification.** The system shall provide the minimum outside air as shown on the mechanical drawings, and shall be measured by the installing licensed C-20 mechanical contractor and certified by (1) the design mechanical engineer, (2) the installing licensed C-20 mechanical contractor, or (3) the person with overall responsibility for the design of the ventilation system; or
 3. **Outside Air Measurement.** The system shall be equipped with a calibrated local or remote device capable of measuring the quantity of outside air on a continuous basis and displaying that quantity on a readily accessible display device; or
 4. **Another method approved by the Commission.**

122(a)-(b)3.

Section 122. Required Controls for Space Conditioning Systems.

Space conditioning systems shall be installed with controls that comply with the applicable requirements of subsections (a) through (h).

- (a) Thermostatic Controls for Each Zone. The supply of heating and cooling energy to each space conditioning zone or dwelling unit shall be controlled by an individual thermostatic control that responds to temperature within the zone and that meets the applicable requirements of subsection (b).

EXCEPTION to Section 122(a): An independent perimeter heating or cooling system may serve more than one zone without individual thermostatic controls if:

- I. All zones are also served by an interior cooling system;
- II. The perimeter system is designed solely to offset envelope heat losses or gains;
- III. The perimeter system has at least one thermostatic control for each building orientation of 50 feet or more; and
- IV. The perimeter system is controlled by at least one thermostat located in one of the zones served by the system.

- (b) Criteria for Zonal Thermostatic Controls. The individual thermostatic controls required by subsection (a) shall meet the following requirements as applicable:

1. Where used to control comfort heating, the thermostatic controls shall be capable of being set, locally or remotely, by adjustment or selection of sensors, down to 55°F or lower.
2. Where used to control comfort cooling, the thermostatic controls shall be capable of being set, locally or remotely, by adjustment or selection of sensors, up to 85°F or higher.
3. Where used to control both comfort heating and comfort cooling, the thermostatic controls shall meet 1. and 2. and shall be capable of providing a temperature range or dead band of at least 5°F within which the supply of heating and cooling energy to the zone is shut off or reduced to a minimum.

EXCEPTION to Section 122(b)3.: Systems with thermostats that require manual changeover between heating and cooling modes.

EXCEPTION to Section 122(b)1., 2., and 3.: Systems serving zones that must have constant temperatures to prevent degradation of materials, a process, or plants or animals.

(c) Hotel/Motel Guest Room and High-Rise Residential Dwelling Unit Thermostats.

Hotel/motel guest room thermostats shall have:

1. Numeric temperature setpoints in degrees F; and
2. Setpoint stops accessible only to authorized personnel, to restrict over-heating and over-cooling.

High-rise residential dwelling unit thermostats shall meet the control requirements of Section 150(i).

(d) Heat Pump Controls. All heat pumps with supplementary electric resistance heaters shall be installed with controls that comply with Section 112(b).

(e) Shut-Off and Reset Controls for Space Conditioning Systems. Each space conditioning system shall be installed with controls that comply with 1. and 2.:

1. The control shall be capable of automatically shutting off the system during periods of non-use and shall have:
 - A. An automatic time switch control device complying with Section 119(c), with an accessible manual override that allows operation of the system for up to 4 hours; or
 - B. An occupancy sensor; or
 - C. A 4-hour timer that can be manually operated.
2. The control shall automatically restart and temporarily operate the system as required to maintain:
 - A. A setback heating thermostat setpoint, if the system provides mechanical heating; and

122(e)2.-(f)

- B. A setup cooling thermostat setpoint, if the system provides mechanical cooling.

EXCEPTION No. 1 to Section 122(e): Where it can be demonstrated to the satisfaction of the enforcing agency that the system serves an area that must operate continuously.

EXCEPTION No. 2 to Section 122(e): Where it can be demonstrated to the satisfaction of the enforcing agency that shutdown, setback, and setup will not result in a decrease in overall building source energy use.

EXCEPTION No. 3 to Section 122(e): Systems with full load demands of 2 kw or less, if they have a readily accessible manual shut-off switch.

EXCEPTION No. 4 to Section 122(e): Systems serving hotel/motel guest rooms, if they have a readily accessible manual shut-off switch.

EXCEPTION to Section 122(e)1.: Mechanical systems serving retail stores and associated malls, restaurants, grocery stores, churches, and theaters equipped with 7-day programmable timers.

EXCEPTION to Section 122(e)2.A.: Thermostat setback controls are not required in areas where the design winter outdoor air temperature determined in accordance with Section 144(b)4 is greater than 32°F.

EXCEPTION to Section 122(e)2.B.: Thermostat setup controls are not required in areas where the design summer outdoor air dry bulb temperature determined in accordance with Section 144(b)4 is less than 100°F.

- (f) Dampers for Air Supply and Exhaust Equipment. Outdoor air supply and exhaust equipment shall be installed with dampers that automatically close during periods of non-use of the areas served by the equipment.

EXCEPTION No. 1 to Section 122(f): Where it can be demonstrated to the satisfaction of the enforcing agency that the equipment serves an area that must operate continuously.

EXCEPTION No. 2 to Section 122(f): Gravity and other non-electrical equipment that has readily accessible manual damper controls.

EXCEPTION No. 3 to Section 122(f): At combustion air intakes and shaft vents.

EXCEPTION No. 4 to Section 122(f): Where prohibited by other provisions of law.

- (g) Isolation Area Devices. Each space conditioning system serving multiple zones with a combined conditioned floor area more than 25,000 square feet shall be designed, installed, and controlled to serve isolation areas.
1. Each zone, or any combination of zones not exceeding 25,000 square feet, shall be a separate isolation area.
 2. Each isolation area shall be provided with isolation devices, such as valves or dampers, that allow the supply of heating or cooling to be setback or shut off independently of other isolation areas.
 3. Each isolation area shall be controlled by a device meeting the requirements of Section 122(e)1.

EXCEPTION to Section 122(g): A zone need not be isolated if it can be demonstrated to the satisfaction of the enforcement agency that the zone must be heated or cooled continuously.

123(a)

Section 123. Requirements for Pipe Insulation.

The piping for all space conditioning and service water heating systems with fluid temperatures listed in Table No. 1-G shall have the amount of insulation specified in subsection (a) or subsection (b). Insulation conductivity shall be determined in accordance with ASTM C 335-84 at the mean temperature listed in Table No. 1-G, and shall be rounded to the nearest 1/100 Btu-inch per hour per square foot per °F.

EXCEPTION No. 1 to Section 123: Factory installed piping within space conditioning equipment certified under Sections 111 or 112.

EXCEPTION No. 2 to Section 123: Piping that conveys fluids with a design operating temperature range between 60°F and 105°F.

EXCEPTION No. 3 to Section 123: Piping that serves process loads, gas piping, cold domestic water piping, condensate drains, roof drains, vents, or waste piping.

EXCEPTION No. 4 to Section 123: Where the heat gain or heat loss to or from piping without insulation will not increase building source energy use.

- (a) For insulation with a conductivity in the range shown in Table No. 1-G for the applicable fluid temperature range, the insulation shall have the applicable thickness shown in the Table.

**TABLE NO. 1-G
PIPE INSULATION THICKNESS**

Fluid Temperature Range, °F	Conductivity Range (in Btu-inch per hour per square foot per ° F)	Insulation Mean Rating Temperature °F	Nominal Pipe Diameter (in inches)						
			Runouts up to 2 Less		1 and	1.25-2	2.50-4	5-6	8 and Larger
Insulation Thickness Required (in inches)									
Space Heating Systems (Steam, Steam Condensate and Hot Water)									
Above 350	0.32 - 0.34	250	1.5	2.5	2.5	3.0	3.5	3.5	
251-350	0.29 - 0.31	200	1.5	2.0	2.5	2.5	3.5	3.5	
201-250	0.27 - 0.30	150	1.0	1.5	1.5	2.0	2.0	3.5	
141-200	0.25 - 0.29	125	0.5	1.5	1.5	1.5	1.5	1.5	
105-140	0.24 - 0.28	100	0.5	1.0	1.0	1.0	1.5	1.5	
Service Water Heating Systems (recirculating sections, all piping in electric trace tape systems, and the first 8 feet of piping from the storage tank for non-recirculating systems)									
Above 105	0.24 - 0.28	100	0.5	1.0	1.0	1.5	1.5	1.5	
Space Cooling Systems (Chilled water, Refrigerant, and Brine)									
40-60	0.23 - 0.27	75	0.5	0.5	0.5	1.0	1.0	1.0	
Below 40	0.23 - 0.27	75	1.0	1.0	1.5	1.5	1.5	1.5	

123(b)

- (b) For insulation with a conductivity outside the range shown in Table No. 1-G for the applicable fluid temperature range, the insulation shall have a minimum thickness as calculated with Equation No. 1-A:

**EQUATION NO.1-A
INSULATION THICKNESS**

$$T = PR [(1 + t/PR)^{K/k} - 1]$$

Where:

- T = Minimum insulation thickness for material with conductivity K, inches.
PR = Pipe actual outside radius, inches.
t = Insulation thickness from Table No. 1-G, inches.
K = Conductivity of alternate material at the mean rating temperature indicated in Table No. 1-G for the applicable fluid temperature range, in Btu-inch per hour per square foot per °F.
k = The lower value of the conductivity range listed in Table No. 1-G for the applicable fluid temperature range, Btu-inch per hour per square foot per °F.

Section 124. Requirements for Ducts and Plenums.

- (a) All ducts shall be installed and insulated in compliance with Sections 601, 603, and 604 of the UMC.

Section 125. [Reserved]

Section 126. [Reserved]

Section 127. [Reserved]

Section 128. [Reserved]

Section 129. [Reserved]

130(a)-(b)3.

**SUBCHAPTER 4 (SECTIONS 130 through 139):
NONRESIDENTIAL, HIGH-RISE RESIDENTIAL, AND HOTEL/MOTEL
OCCUPANCIES -- MANDATORY REQUIREMENTS FOR LIGHTING SYSTEMS
AND EQUIPMENT.**

Section 130. Lighting Systems and Equipment -- General.

- (a) Except as provided in (b) the design and installation of all lighting systems and equipment in nonresidential, high-rise residential, and hotel/motel buildings subject to Title 24, Part 6 shall comply with the applicable provisions of Sections 131 through 139.
- (b) The design and installation of all lighting systems and equipment in high-rise residential living quarters and in hotel/motel guest rooms shall comply with the following:
 - 1. Luminaires for general lighting in kitchens shall have lamps with an efficacy of not less than 40 lumens per watt. A luminaire which is the only lighting in a kitchen will be considered general lighting. General lighting shall be controlled by the most accessible switch(es) in the kitchen.

Additional luminaires to be used only for specific decorative effects need not meet this requirement.

- 2. Each room containing a water closet shall have at least one luminaire with lamps with an efficacy of not less than 40 lumens per watt. If there is more than one luminaire in the room, the high efficacy luminaire shall be switched at an entrance to the room. The efficacy requirement may be met by installing the luminaire meeting this requirement in an adjacent room that has complementary plumbing fixtures.
- 3. Luminaires installed to meet the 40 lumens per watt requirements of subsections 1. or 2. shall not contain medium base incandescent lamp sockets, and shall be on separate switches from any incandescent lighting.

4. All incandescent lighting fixtures recessed into insulated ceilings shall be approved for zero-clearance insulation cover (I.C.) by Underwriters Laboratories or other testing/rating laboratories recognized by the International Conference of Building Officials.

EXCEPTION to Section 130(b): Up to 10 percent of the guest rooms in a hotel/motel need not comply.

Section 131. Lighting Controls That Must Be Installed.

(a) Area Controls.

1. Each area enclosed by ceiling-height partitions shall have an independent switching or control device. This switching or control device shall be:
 - A. Readily accessible; and
 - B. Located so that a person using the device can see the lights or area controlled by that switch, or so that the area being lit is annunciated; and
 - C. Manually operated, or automatically controlled by an occupant-sensing device that meets the requirements of Section 119(d).
2. Other devices may be installed in conjunction with the switching or control device provided that they:
 - A. Permit the switching or control device to override the action of all other devices; and
 - B. Reset the mode of any automatic system to normal operation without further action.

EXCEPTION No. 1 to Section 131(a): Up to one-half watt per square foot of lighting in any area within a building that must be continuously illuminated for reasons of building security or emergency egress, if:

- I. The area is designated a security or emergency egress area on the plans and specifications submitted to the enforcement agency under Section 10-103(a)(2) of Title 24, Part 1; and
- II. The area is controlled by switches accessible only to authorized personnel.

EXCEPTION No. 2 to Section 131(a): Public areas with switches that are accessible only to authorized personnel.

- (b) Controls to Reduce Lighting. The general lighting of any enclosed space 100 square feet or larger in which the connected lighting load exceeds 1.2 watts per square foot for the space as a whole, and that has more than one light source

(luminaire), shall be controlled so that the load for the lights may be reduced by at least one-half while maintaining a reasonably uniform level of illuminance throughout the area. A reasonably uniform reduction of illuminance shall be achieved by:

1. Controlling all lamps or luminaires with dimmers; or
2. Dual switching of alternate rows of luminaires, alternate luminaires, or alternate lamps; or
3. Switching the middle lamps of three lamp luminaires independently of the outer lamps; or
4. Switching each luminaire or each lamp.

EXCEPTION No. 1 to Section 131(b): Lights in areas that are controlled by an occupant-sensing device that meets the requirements of Section 119(d).

EXCEPTION No. 2 to Section 131(b): Lights in corridors.

EXCEPTION No. 3 to Section 131(b): Lights in areas that are controlled by an automatic time switch control device that has a timed manual override available at each switch location required by Section 131(a) and that controls only the lights in the area enclosed by ceiling height partitions.

(c) Daylit Areas. Daylit areas in any enclosed space greater than 250 square feet shall meet the requirements of 1. and 2.

1. Such areas shall have at least one control that:
 - A. Controls only luminaires in the daylit area; and
 - B. Controls at least 50% of the lamps or luminaires in the daylit area, in a manner described in Section 131(b)1. through 4., independently of all other lamps or luminaires in the enclosed space. The other luminaires in the enclosed space may be controlled in any manner allowed by Section 131(b)1. through 4.
2. Such areas shall have controls that control the luminaires in each vertically daylit area separately from the luminaires in each horizontally daylit area.

131(c)2.-(d)1.

EXCEPTION No. 1 to Section 131(c): Daylit areas where the effective aperture of glazing is equal to or less than 0.1 for vertical glazing and 0.01 for horizontal glazing.

EXCEPTION No. 2 to Section 131(c): Daylit areas where existing adjacent structures or natural objects obstruct daylight to the extent that effective use of daylighting is not feasible.

(d) Shut-Off Controls.

1. For every floor, all interior lighting systems shall be equipped with a separate automatic control to shut off the lighting. This automatic control shall meet the requirements of Section 119 and may be an occupancy sensor, automatic time switch, or other device capable of automatically shutting off the lighting.

EXCEPTION No. 1 to Section 131(d)1.: Buildings or separately metered spaces of less than 5,000 square feet of conditioned space.

EXCEPTION No. 2 to Section 131(d)1.: Where the system is serving an area that must be continuously lit, or lit in a manner requiring manual operation of the lighting.

EXCEPTION No. 3 to Section 131(d)1.: Lighting in corridors, guest rooms, and lodging quarters of high-rise residential buildings and hotel/motels.

EXCEPTION No. 4 to Section 131(d)1.: Up to one-half watt per square foot of lighting in any area within a building that must be continuously illuminated for reasons of building security or emergency egress, if:

- I. The area is designated a security or emergency egress area on the plans and specifications submitted to the enforcement agency under Section 10-103(a)2.A. of Title 24, Part 1; and
- II. The area is controlled by switches accessible only to authorized personnel.

2. If an automatic time switch control device is installed to comply with Section 131(d)1. it shall incorporate an override switching device that:
- A. Is readily accessible; and
 - B. Is located so that a person using the device can see the lights or the area controlled by that switch, or so that the area being lit is annunciated; and
 - C. Is manually operated; and
 - D. Allows the lighting to remain on for no more than two hours when an override is initiated; and
 - E. Controls an area not exceeding 5,000 square feet.

EXCEPTION to Section 131(d)2D: In malls and arcades, auditoriums, single tenant retail spaces, industrial facilities, and arenas, where captive-key override is utilized, override time may exceed 2 hours.

EXCEPTION to Section 131(d)2E: In malls and arcades, auditoriums, single tenant retail spaces, industrial facilities, and arenas, the area controlled may not exceed 20,000 square feet.

3. If an automatic time switch control device is installed to comply with Section 131(d)1. it shall incorporate an automatic holiday "shut-off" feature that turns off all loads for at least 24 hours, then resumes the normally scheduled operation.

EXCEPTION to Section 131(d)3.: Retail stores and associated malls, restaurants, grocery stores, churches and theaters.

- (e) Display Lighting. Display lighting shall be separately switched on circuits that are 20 amps or less.
- (f) Exterior Lighting. Exterior lighting controlled from a lighting panel within the building shall be controlled by a directional photocell or astronomical time switch that automatically turns off the exterior lighting when daylight is available.

EXCEPTION to Section 131(f): Lighting in parking garages, tunnels, and large covered areas that require illumination during daylight hours.

Section 132. Requirements for Lighting Circuiting.

The following shall be tandem wired and shall not use single lamp ballasts:

- (a) Pairs of one-lamp or three-lamp recessed fluorescent luminaires that are (1) on the same switch control, (2) in the same area, and (3) within 10 feet of each other in accessible ceiling spaces; and
- (b) Continuous mounted pendant and continuous surface mounted luminaires.

EXCEPTION No. 1 to Section 132: Fluorescent lighting luminaires that use electronic high frequency ballasts.

EXCEPTION No. 2 to Section 132: Single lamp ballasts may be used for odd lamp quantities or in conjunction with emergency battery-ballast units in even-numbered lamp luminaires.

EXCEPTION to Sections 131 through 132: Exit signs and illumination subject to Section 113 or 114 of the State Building Code, and lighting whose switching is regulated by Article 3-700 of the State Electrical Code (Title 24, Part 3).

Section 133. [Reserved]

Section 134. [Reserved]

Section 135. [Reserved]

Section 136. [Reserved]

Section 137. [Reserved]

Section 138. [Reserved]

Section 139. [Reserved]

**SUBCHAPTER 5 (SECTIONS 140 through 148):
NONRESIDENTIAL, HIGH-RISE RESIDENTIAL, AND HOTEL/MOTEL
OCCUPANCIES -- PERFORMANCE AND PRESCRIPTIVE COMPLIANCE
APPROACHES FOR ACHIEVING ENERGY EFFICIENCY**

Section 140. Choice of Performance and Prescriptive Approaches.

The envelope and the space conditioning, lighting, and service water heating systems of all nonresidential, high-rise residential, and hotel/motel buildings subject to Title 24, Part 6 shall be designed, constructed, and installed either:

- (a) Performance Approach -- to use no more source energy from depletable sources than the energy budget, calculated according to Section 141; or
- (b) Prescriptive Approach -- in accordance with all the applicable requirements of sections 142 through 146.

Section 141. Performance Approach: Energy Budgets.

In order to meet the energy budget, a proposed building's use of source energy calculated under subsection (b) must be no greater than the energy budget calculated under subsection (a).

- (a) Energy Budget. The energy budget for a proposed building is the sum of the space conditioning, lighting, and service water heating budgets in subdivisions 1., 2., and 3. of this subsection, expressed in Btu per square foot of conditioned floor area per year.
1. Space Conditioning Budget. The space conditioning budget is the source energy used for space conditioning in a standard building in the Climate Zone in which the proposed building is located, calculated with a method approved by the Commission (expressed in Btu per square foot of conditioned floor area per year), and assuming that:
 - A. The standard building has space heating, space cooling, and ventilation systems that meet but do not exceed the minimum efficiency requirements of Section 111 and 112, and the requirements of Section 144; and
 - B. The performance of the roof/ceiling, walls, floors and soffits, windows, and skylights is equal to an applicable value using the same assembly type from Table No. 1-I or 1-J; and
 - C. The zoning, the orientation of each building feature, and the gross envelope areas of the standard building are the same as in the proposed building; and
 - D. The window area of the standard building is the greater of (1) or (2): (1) the window area of the proposed building excluding the window area in demising walls, or 40% of the gross exterior wall area of the standard building, whichever is less; or (2) 6 feet times the display perimeter; and
 - E. The skylight area of the standard building is the same as in the proposed building, or is 5% of the gross exterior roof/ceiling area of the standard building, whichever is less.

2. Lighting Budget. The lighting budget is the source energy used for lighting in a standard building calculated with a method approved by the Commission (expressed in Btu per square foot of conditioned floor area per year), and assuming that:
 - A. The lighting power density of the standard building, for areas where no lighting plans or specifications are submitted for permit and the occupancy of the building is known, is the maximum allowed lighting power density calculated according to Section 146(b)1; and
 - B. The lighting power density of the standard building, for areas where no lighting plans or specifications are submitted for permit, and the occupancy of the building is not known, is 1.5 watts per square foot; and
 - C. The lighting power density of the standard building, for areas where lighting plans and specifications are being submitted for permit, is the maximum allowed lighting power density calculated according to Section 146(b)1., 2., or 3.
 3. Service Water Heating Budget. The service water heating budget is the source energy used for service water heating in a standard building in the Climate Zone in which the proposed building is located, calculated with a method approved by the Commission (expressed in Btu per square foot of conditioned floor area per year), and assuming that the standard building has a service water heating system that meets but does not exceed the applicable requirements of Sections 111, 113, and 123.
- (b) Source Energy Use of Proposed Building. The source energy use of a proposed building is the sum of the space conditioning, lighting, and service water heating source energy use calculated in subdivisions 1., 2., and 3. of this subsection, using the same ACM used to calculate the budget under subsection (a), and expressed in Btu per square foot of conditioned floor area per year. If any feature of the proposed building, including but not limited to the envelope or the space conditioning, lighting, or service water heating system, is not included in the building permit application, the energy performance of the feature shall be assumed to be that of the corresponding feature calculated in subsection (a).

141(b)1.-(c)3.

1. Space Conditioning Source Energy Use. The space conditioning source energy use shall be calculated by:
 - A. Using a method approved by the Commission; and
 - B. Using the proposed building's space heating, space cooling, lighting, and ventilation systems, roof and ceiling, walls, floors and soffits, opaque envelope areas, windows, skylights, zoning, and orientation, as shown on the plans and specifications submitted in the building permit application under Section 10-103 of Title 24, Part 1.
 2. Lighting Source Energy Use. The lighting source energy use shall be calculated using a method approved by the Commission, and using the actual lighting power density calculated under Section 146(a), including reduction of wattage through controls.
 3. Service Water Heating Source Energy Use. The service water heating source energy use shall be calculated using a method approved by the Commission, and using the proposed building's actual service water heating system.
- (c) Calculation of Budget and Energy Use. When calculating the energy budget under subsection (a) and the source energy use under subsection (b), all of the following rules shall apply:
1. Methodology. The methodology, computer programs, inputs, and assumptions approved by the Commission shall be used.
 2. Energy Included. All energy from depletable sources used for space conditioning, lighting, and service water heating shall be included.
 3. Energy Excluded. The following energy shall be excluded:
 - A. Process loads; and
 - B. Loads of redundant or back-up equipment, if the plans submitted under Section 10-103 of Title 24, Part 1, show controls that will allow the redundant or back-up equipment to operate only when the primary equipment is not operating, and if such controls are installed; and
 - C. Recovered energy; and

- D. Additional energy use caused solely by outside air filtration and treatment for the reduction and treatment of unusual outdoor contaminants with final pressure drops more than one inch water column. Only the energy accounted for by the amount of the pressure drop that is over one inch may be excluded.

4. U-Values. U-values shall be calculated as follows:

- A. All Building Components. The U-value of all building components shall be calculated to three decimal places; the calculations shall assume still inside air and a 15 mph outside air velocity, or other assumptions approved by the Commission.
- B. Wood Framed Assemblies. U-values for wood framed assemblies shall be calculated using the parallel path method listed in ASHRAE Handbook, 1989, Fundamentals Volume, Chapter 22, with framing factors approved by the Commission.
- C. Metal Framed Assemblies. U-values for metal framed assemblies shall be calculated using the zone method listed in ASHRAE Handbook, 1989, Fundamentals Volume, Chapter 22 or a method approved by the Commission.
- D. Fenestration. U-values for fenestration shall be determined as follows:
- i. For site constructed windows, U-values shall include the effects of framing and shall be determined using the commercial size category values listed in ASHRAE Handbook, 1989, Fundamentals Volume, Chapter 27, Table 13; or
 - ii. For manufactured windows, U-values shall be as certified under Section 116; or
 - iii. Using a method approved by the Commission.
- E. Masonry Assemblies. U-values for masonry assemblies shall be calculated using the transverse isothermal planes method listed in ASHRAE Handbook, 1989, Fundamentals Volume, Chapter 22, or a method approved by the Commission.

141(c)4.-6.

- F. Other. U-values for components not listed in this subsection shall be calculated using a method approved by the Commission.
- 5. Shading Coefficients. Shading coefficients shall be determined using the values listed in ASHRAE Handbook, 1989, Fundamentals Volume, Chapter 27 or a method approved by the Commission, and shall not be adjusted for the effects of framing and interior or exterior shading devices.
- 6. Visible Light Transmittance. Visible light transmittance shall be determined using the values listed in ASHRAE Handbook, 1989, Fundamentals Volume, Chapter 27 or manufacturers literature, and shall be adjusted for the effects of framing and interior or exterior shading devices.

Section 142. Prescriptive Approach.

In order to comply with the prescriptive approach under this Section, a building shall be designed with and shall have constructed and installed:

- (a) A building envelope that complies with Section 143(a) or 143(b);
- (b) A space conditioning system that complies with Section 144;
- (c) A service water heating system that complies with Section 145; and
- (d) A lighting system that complies with Section 146.

Section 143. Prescriptive Requirements For Building Envelopes.

A building complies with this section by being designed with and having constructed and installed either (I) envelope components that comply with the each of the requirements in subsection (a) for each individual component, or (II) an envelope that complies with the overall requirements in subsection (b). When making calculations under subsection (a) or subsection (b), all of the rules listed in Sections 141(c)1., 4., and 5. shall apply.

(a) Envelope Component Approach.

1. Exterior Roofs and Ceilings. Exterior roofs and ceilings shall have either an installed insulation R-value no less than, or an overall assembly U-value no greater than, the applicable value in Table No. 1-I or 1-J.
2. Exterior Walls. Exterior walls shall have either an installed insulation R-value no less than, or an overall assembly U-value no greater than, the applicable value in Table No. 1-I or 1-J.
3. Demising Walls. The opaque portions of framed demising walls in nonresidential buildings shall have insulation with an installed insulation R-value no less than R-11 between framing members.
4. External Floors and Soffits. External floors and soffits shall have either an installed insulation R-value no less than, or an overall assembly U-value no greater than, the applicable value in Table No. 1-I or 1-J.
5. Windows. Windows shall:
 - A. Have an area no greater than 40% of the gross exterior wall area, or six feet times the display perimeter, whichever is greater; and

 EXCEPTION to 143(a)5.A.: Window area in demising walls is not counted as part of the window area for this requirement. Demising wall area is not counted as part of the gross exterior wall area or display perimeter.
 - B. Have a U-value no greater than the applicable value in Table No. 1-I or 1-J; and
 - C. Have a relative solar heat gain, excluding the effects of interior shading, no greater than the applicable value in Table No. 1-I or 1-J. The relative solar heat gain of windows is:

- i. The shading coefficient of the windows; or
- ii. Relative Solar Heat Gain as calculated by Equation No. 1-B, if an overhang extends beyond both sides of the window jamb a distance equal to the overhang projection.

EXCEPTION to Section 143(a)5.C.: The applicable "North" value for relative solar heat gain in Table No. 1-I and 1-J shall be used for windows:

- I. that are in the first story of exterior walls that form a display perimeter; and
- II. for which codes restrict the use of overhangs to shade the windows.

EQUATION NO. 1-B
RELATIVE SOLAR HEAT GAIN EQUATION

$$\text{RSHG} = \text{SC}_{\text{win}} \times [1 + aH/V + b(H/V)^2]$$

Where:

- RSHG = Relative solar heat gain.
- SC_{win} = Shading coefficient of the window.
- H = Horizontal projection of the overhang from the surface of the window in feet, but no greater than V.
- V = Vertical distance from the window sill to the bottom of the overhang, in feet.
- a = -0.41 for North-facing windows, -1.22 for South-facing windows, and -0.92 for East- and West-facing windows.
- b = 0.20 for North-facing windows, 0.66 for South-facing windows, and 0.35 for East- and West-facing windows.

143(a)6.-7.

6. Skylights. Skylights shall:
 - A. Have an area no greater than 5% of the gross exterior roof area; and

EXCEPTION to Section 143(a)6.A.: Atria over 55 feet high shall have a skylight area no greater than 10 percent of the gross exterior roof area.
 - B. Have a U-value no greater than the applicable value in Table No. 1-I or 1-J; and
 - C. Have a shading coefficient no greater than the applicable value in Table No. 1-I or 1-J.
7. Exterior Doors. Exterior doors have no R-value, U-value, or area requirements.

TABLE NO. 1-I

**PRESCRIPTIVE ENVELOPE CRITERIA
FOR NONRESIDENTIAL BUILDINGS (EXCEPT HIGH-RISE RESIDENTIAL
BUILDINGS AND GUEST ROOMS OF HOTEL/MOTEL BUILDINGS)**

	Climate Zones				
	1,16	2-5	6-10	11-13	14-15
Roof/Ceiling					
<u>R-Value</u>	19	19	11	19	19
OR					
<u>U-Value</u>	0.057	0.057	0.078	0.057	0.057
Wall					
<u>R-Value</u>	13	11	11	13	13
OR					
<u>U-Value</u>					
Wood Frame	0.084	0.092	0.092	0.084	0.084
Metal Frame	0.182	0.189	0.189	0.182	0.182
Mass/ $7.0 \leq HC < 15.0$	0.340	0.430	0.430	0.430	0.430
Mass/ $15.0 \leq HC$	0.360	0.650	0.690	0.650	0.400
Other	0.084	0.092	0.092	0.084	0.084
Floor/Soffit					
<u>R-Value</u>	19	11	11	11	11
OR					
<u>U-Value</u>					
Mass/ $7.0 \leq HC$	0.097	0.158	0.158	0.097	0.158
Other	0.050	0.076	0.076	0.076	0.076
Windows					
<u>U-value</u>	0.72	1.23	1.23	0.72	0.72
<u>Relative Solar Heat Gain</u>					
North	0.88	0.94	0.94	0.88	0.88
Non-North	0.57	0.71	0.71	0.57	0.57
Skylights					
<u>U-value</u>	0.85	1.31	1.31	0.85	0.85
<u>Shading Coefficient</u>					
Transparent	0.50	0.70	0.70	0.50	0.50
Translucent	0.81	0.86	0.86	0.81	0.81

TABLE NO. 1-J

**PRESCRIPTIVE ENVELOPE CRITERIA
FOR HIGH-RISE RESIDENTIAL BUILDINGS AND GUEST ROOMS
OF HOTEL/MOTEL BUILDINGS**

	Climate Zones				
	1,16	2-5	6-10	11-13	14-15
Roof/Ceiling					
<u>R-Value</u>	30	19	19	30	30
<u>OR</u>					
<u>U-Value</u>	0.037	0.051	0.051	0.037	0.037
Wall					
<u>R-Value</u>	19	11	11	13	13
<u>OR</u>					
<u>U-Value</u>					
Wood Frame	0.063	0.092	0.092	0.084	0.084
Metal Frame	0.140	0.181	0.181	0.175	0.175
Mass/ $7.0 \leq HC < 15.0$	0.340	0.430	0.430	0.430	0.430
Mass/ $15.0 \leq HC$	0.360	0.650	0.690	0.650	0.400
Other	0.063	0.092	0.092	0.084	0.084
Floor/Soffit					
<u>R-Value</u>	19	11	11	11	11
<u>OR</u>					
<u>U-Value</u>					
Mass/ $7.0 \leq HC$	0.097	0.158	0.158	0.097	0.097
Other	0.050	0.076	0.076	0.076	0.076
Windows					
<u>U-value</u>	0.72	1.23	1.23	0.72	0.72
<u>Relative Solar Heat Gain</u>					
North	0.88	0.94	0.94	0.88	0.88
Non-North	0.88	0.94	0.71	0.57	0.57
Skylights					
<u>U-value</u>	0.85	1.31	1.31	0.85	0.85
<u>Shading Coefficient</u>					
Transparent	0.50	0.70	0.70	0.50	0.50
Translucent	0.81	0.86	0.86	0.81	0.81

(b) Overall Envelope Approach.

1. Overall Heat Loss. The overall heat loss (HL) of the overall envelope of the proposed building, HL_{prop} as calculated with Equation No. 1-D, shall be no greater than the overall heat loss of a standard building, HL_{std} as calculated with Equation No. 1-C. In making the calculations, it shall be assumed that the orientation and area of each envelope component is the same as in the proposed building, except as described below.

EQUATION NO. 1-C
STANDARD BUILDING HEAT LOSS EQUATION

$$HL_{std} = (A_W \times U_{Wreq}) + (A_F \times U_{Freq}) + (A_R \times U_{Rreq}) + (A_G \times U_{Greq}) + (A_S \times U_{Sreq})$$

Where:

- HL_{std} = Overall heat loss of the standard building.
- A_W = Total exterior wall area of the proposed building (in ft²) plus the window area of the proposed building, minus A_G .
- A_F = Total exterior floor/soffit area of the proposed building (in ft²).
- A_R = Total exterior roof/ceiling area of the proposed building (in ft²) plus the skylight area of the proposed building, less A_{sk} .
- A_G = Total window area of the proposed building. If the window wall ratio of the proposed building is no more than 40%, the window area is the greater of (a) 10% of the gross exterior wall area, or (b) the window area of the proposed building. If the window wall ratio of the proposed building is more than 40%, the window area is the greater of (a) 40% of the gross exterior wall area, or (b) 6 feet times the display perimeter (in ft²).
- A_{sk} = Total skylight area of the proposed building or 5% of the gross exterior roof area (or, for atria over 55 feet high, 10 percent of the gross exterior roof area), whichever is less (in ft²).
- U_{Wreq} = The applicable wall U-value from Table No. 1-I or 1-J, provided that if the proposed building has walls in more than one HC category, then U_{Wreq} = average U-value for all walls, weighted by the area of each wall category.
- U_{Freq} = The applicable floor/soffit U-value from Table No. 1-I or 1-J, provided that if the proposed building has floors/soffits in more than one HC category, then U_{Freq} = average U-value for all floors/soffits, weighted by the area of each floor/soffit category.
- U_{Rreq} = The applicable roof/ceiling U-value from Table No. 1-I or 1-J, provided that if the proposed building has roofs or ceilings in more than one category, then U_{Rreq} = average U-value for all roofs and ceilings, weighted by the area of each roof or ceiling category.
- U_{Greq} = The applicable window U-value from Table No. 1-I or 1-J.
- U_{Sreq} = The applicable skylight U-value from Table No. 1-I or 1-J.

EQUATION 1-D
PROPOSED BUILDING HEAT LOSS EQUATION

$$HL_{prop} = (A_W \times U_{Wprop}) + (A_F \times U_{Fprop}) + (A_R \times U_{Rprop}) + (A_G \times U_{Gprop}) + (A_S \times U_{Sprop})$$

Where:

- HL_{prop} = Overall heat loss of the proposed building.
 A_W = Total exterior wall area of the proposed building (in ft²).
 A_F = Total exterior floor/soffit area of the proposed building (in ft²).
 A_R = Total exterior roof/ceiling area of the proposed building (in ft²).
 A_G = Total window area of the proposed building (in ft²).
 A_{Sk} = Total skylight area of the proposed building (in ft²).
 U_{Wprop} = The wall U-value of the proposed building, provided that if the proposed building has walls of more than one U-value, then U_{Wprop} = average U-value for all walls, weighted by the area of each wall category.
 U_{Fprop} = The floor/soffit U-value of the proposed building, provided that if the proposed building has floors/soffits of more than one U-value, then U_{Fprop} = average U-value for all floors/soffits, weighted by the area of each floor/soffit category.
 U_{Rprop} = The roof/ceiling U-value of the proposed building, provided that if the proposed building has roofs or ceilings in more than one category, then U_{Rprop} = average U-value for all roofs and ceilings, weighted by the area of each roof or ceiling category.
 U_{Gprop} = The window U-value of the proposed building.
 U_{Sprop} = The skylight U-value of the proposed building.

143(b)2.

2. Overall Heat Gain. The overall heat gain of the windows and skylights of the proposed building, HG_{prop} as calculated with Equation No. 1-F, shall be no greater than the overall heat gain of the windows and skylights of a standard building, HG_{std} as calculated with Equation No. 1-E. In making the calculations, it shall be assumed that the orientation and area of each envelope component of the standard building are the same as in the proposed building except as described below.

EQUATION NO. 1-E
STANDARD BUILDING HEAT GAIN EQUATION

$$HG_{std} = (A_{Gn} \times W_n \times RSHG_{Gnreq}) + (((A_{Ge} \times W_e) + (A_{Gs} \times W_s) + (A_{Gw} \times W_w)) \times RSHG_{Greq}) + (A_{Sk} \times W_{Sk} \times SC_{Skreq})$$

Where:

HG_{std} = Overall heat gain of the standard building (unitless)

$A_{Gn}, A_{Ge}, A_{Gs}, A_{Gw}$ = Window area on the north, east, south, and west orientations, respectively, of the proposed building (in ft²). If the total window area of the proposed building exceeds A_G as determined in Equation No. 1-C, or is less than 10% of the gross exterior wall area, the window area on each orientation of the standard design is increased or decreased in proportion to the area in the proposed design according to the following formula:

$$A_{Gj} = (A_{Gj \text{ prop}} / A_{G \text{ total prop}}) \times A$$

Where:

A_{Gj} = $A_{Gn}, A_{Ge}, A_{Gs}, A_{Gw}$ respectively
 $A_{Gj \text{ prop}}$ = Actual proposed window area of each respective orientation
 $A_{G \text{ total prop}}$ = Total actual proposed window area of the building
 A_G = A_G as determined in Equation No. 1-C
 A_w = A_w as determined in Equation No. 1-C
 A_{Sk} = Total skylight area of the proposed building or 5% of the gross exterior roof area (or for atria over 55 feet high, 10 percent of the gross exterior roof area), whichever is less (in ft²).

$RSHG_{Greq}$ = The applicable relative solar heat gain for a non-north window, from Table No. 1-I or 1-J.

$RSHG_{Gnreq}$ = The applicable relative solar heat gain for a north window, from Table No. 1-I or 1-J.

$W_n, W_e, W_s,$
 W_w, W_{sk} = The applicable weighting factor for each orientation, from Table No. 1-K.

SC_{Skreq} = The applicable shading coefficient for skylight, from Table No. 1-I or 1-J.

**EQUATION NO. 1-F
PROPOSED BUILDING HEAT GAIN EQUATION**

$$HG_{prop} = \Sigma[(A_{Gi} \times SC_{Gi} \times OH_{Gi} \times W_{Gi}) + (W_{Sk} \times \Sigma(A_{Ski} \times SC_{Ski}))]$$

Where:

HG_{prop} = Overall heat gain of the proposed building (unitless).

A_{Gi} = Window area of each window (in ft²).

SC_{Gi} = The shading coefficient of the window (unitless).

OH_{Gi} = The overhang factor of the window (unitless).

$$OH_{Gi} = 1 + aH/V + b(H/V)^2.$$

Where:

H = Horizontal projection of an overhang from the surface of the window, no greater than V , in feet.

V = Vertical distance from the window sill to the bottom of the overhang, in feet.

a = -0.41 for North-facing windows, -1.22 for South-facing windows, and -0.92 for East- and West-facing windows.

b = 0.20 for North-facing windows, 0.66 for South-facing windows, and 0.35 for East- and West-facing windows.

W_{Gi} = The applicable weighting factor for the window, from Table No. 1-K (unitless).

W_{sk} = The applicable weighting factor for the skylight, from Table No. 1-K (unitless).

A_{Ski} = Area of the skylight (in ft²).

SC_{Ski} = The shading coefficient of the skylight (unitless).

i = Each window or skylight.

**TABLE NO. 1-K
GLAZING ORIENTATION WEIGHTING FACTORS**

Climate Zone	<u>1,16</u>	<u>2-5</u>	<u>6-10</u>	<u>11-13</u>	<u>14,15</u>
North	0.63	0.52	0.34	0.42	0.67
East	1.14	1.05	1.02	1.27	1.08
South	0.99	1.24	1.31	1.14	1.12
West	1.24	1.19	1.34	1.17	1.13
Skylight	2.54	2.74	2.30	2.54	2.45

Section 144. Prescriptive Requirements For Space Conditioning Systems.

A building complies with this section by being designed with and having constructed and installed a space conditioning system that meets the requirements of subsections (a) through (g).

- (a) Sizing and Equipment Selection. Mechanical heating and mechanical cooling equipment shall be the smallest size, within the available options of the desired equipment line, necessary to meet the design heating and cooling loads of the building, as calculated according to subsection (b).

EXCEPTION No. 1 to Section 144(a): Where it can be demonstrated to the satisfaction of the enforcing agency that oversizing will not increase building source energy use.

EXCEPTION No. 2 to Section 144(a): Standby equipment with controls that allow the standby equipment to operate only when the primary equipment is not operating.

EXCEPTION No. 3 to Section 144(a): Multiple units of the same equipment type, such as multiple chillers and boilers, having combined capacities exceeding the design load, if they have controls that sequence or otherwise optimally control the operation of each unit based on load.

- (b) Calculations. In making equipment sizing calculations under subsection (a), all of the following rules shall apply:
1. Methodology. The methodologies, computer programs, inputs, and assumptions approved by the Commission shall be used.
 2. Heating and Cooling Loads. Heating and cooling system design loads shall be determined in accordance with the procedures described in the ASHRAE Handbook, 1989, Fundamentals Volume or as specified in a method approved by the Commission.
 3. Indoor Design Conditions. Indoor design temperature and humidity conditions for general comfort applications shall be determined in accordance with ANSI/ASHRAE 55-1981 or Chapter 8 of the ASHRAE Handbook, 1989, Fundamentals Volume, except that winter humidification and summer dehumidification shall not be required.

4. Outdoor Design Conditions. Outdoor design conditions shall be selected from ASHRAE publication SPCDX: Climatic Data for Region X, Arizona, California, Hawaii, and Nevada, 1982. Heating design temperatures shall be no lower than the temperature listed in the Winter Median of Extremes column. Cooling design dry bulb temperatures shall be no greater than the temperature listed in the Summer Design Dry Bulb 0.5% column. Cooling design wet bulb temperatures shall be no greater than the temperature listed in the Summer Design Wet Bulb 0.5% column.
5. Ventilation. Outdoor air ventilation loads shall be calculated using the ventilation rates required in Section 121.
6. Envelope. Envelope heating and cooling loads shall be calculated using envelope characteristics including square footage, thermal conductance, shading coefficient, and air leakage, consistent with the proposed design.
7. Lighting. Lighting loads shall be based on actual design lighting levels or power densities consistent with Section 146.
8. People. Occupant density shall be based on the expected occupancy of the building and shall be the same as determined under Section 121(b)2B, if used. Sensible and latent heat gains shall be as listed in ASHRAE Handbook, 1989, Fundamentals Volume, Chapter 26, Table 3.
9. Miscellaneous Equipment. Equipment loads shall be calculated using design data compiled from one or more of the following sources:
 - A. Actual information based on the intended use of the building; or
 - B. Published data from manufacturer's technical publications and from technical societies, such as the ASHRAE Handbook, 1987 Systems and Applications Volume; or
 - C. Other data based on the designer's experience of expected loads and occupancy patterns.
10. Internal Heat Gains. Internal heat gains may be ignored for heating load calculations.
11. Safety Factor. Design loads may be increased by up to 10% to account for unexpected loads or changes in space usage.

12. Pick-up Loads. Transient loads such as warm-up or cool-down shall be calculated from principles based on the heat capacity of the building and its contents, the degree of setback, and desired recovery time; or may be assumed to be no more than 30% for heating and 10% for cooling of the steady-state design loads. The steady-state load may include a safety factor in accordance with Section 144(b)11.
- (c) Power Consumption of Fans. Each fan system used for comfort space conditioning with a total fan system power demand over 25 horsepower shall meet the requirements of 1. or 2. below, as applicable. Total fan system power demand equals the sum of the power demand of all fans in the system that are required to operate at design conditions in order to supply air from the heating or cooling source to the conditioned space, and to return it back to the source or to exhaust it to the outdoors; however, total fan system power demand need not include the additional power demand caused solely by air treatment or filtering systems with final pressure drops more than 1 inch Water Column (only the energy accounted for by the amount of pressure drop that is over one inch may be excluded), or fan system power caused solely by process loads.
1. Constant Volume Fan Systems. The total fan system power demand of each fan system at design conditions shall not exceed 0.8 watts per cfm of supply air.
 2. Variable Air Volume (VAV) Systems.
 - A. The total fan system power demand of each fan system at design conditions shall not exceed 1.25 watts per cfm of supply air; and
 - B. Individual VAV fans with motors 50 HP and larger shall include controls that limit the fan motor demand to no more than 50% of design wattage at 50% of design air volume.
- (d) Space Conditioning Zone Controls. Each space conditioning zone shall have controls that prevent:
1. Reheating; and
 2. Recooling; and

144(d)3.-(e)1.

3. Simultaneous provisions of heating and cooling to the same zone, such as mixing or simultaneous supply of air that has been previously mechanically heated and air that has been previously cooled, either by cooling equipment or by economizer systems.

EXCEPTION No. 1 to Section 144(d): Zones served by a variable air volume system that is designed and controlled to reduce, to a minimum, the volume of reheated, recooled, or mixed air supply. For each zone, this minimum volume shall be no greater than the largest of the following:

- I. 30% of the peak supply volume; or
- II. The minimum required to meet the ventilation requirements of Section 121;
or
- III. 0.4 cubic feet per minute per square foot of conditioned floor area of the zone; or
- IV. 300 cfm.

EXCEPTION No. 2 to Section 144(d): Zones with special pressurization relationships or cross-contamination control needs.

EXCEPTION No. 3 to Section 144(d): Zones served by space conditioning systems in which at least 75% of the energy for reheating, or providing warm air in mixing systems, is provided from a site recovered or site solar energy source.

EXCEPTION No. 4 to Section 144(d): Zones in which specific humidity levels are required to satisfy process needs.

EXCEPTION No. 5 to Section 144(d): Zones with a peak supply air quantity of 300 cfm or less.

(e) Economizers.

1. Each individual cooling fan system that has a design supply capacity over 2,500 cfm and a total mechanical cooling capacity over 75,000 Btu/hr shall include either:
 - A. An air economizer capable of modulating outside air and return air dampers to supply 100% of the design supply air quantity as outside air; or

- B. A water economizer capable of providing 100% of the expected system cooling load as calculated in accordance with a method approved by the Commission, at outside air temperatures of 50°F dry-bulb/45°F wet-bulb and below.

EXCEPTION No. 1 to Section 144(e)1.: Where it can be shown to the satisfaction of the enforcing agency that special outside air filtration and treatment, for the reduction and treatment of unusual outdoor contaminants, makes compliance infeasible.

EXCEPTION No. 2 to Section 144(e)1.: Where the use of outdoor air for cooling will affect other systems, such as humidification, dehumidification, or supermarket refrigeration systems, so as to increase overall building source energy use.

EXCEPTION No. 3 to Section 144(e)1.: Systems serving high-rise residential living quarters and hotel/motel guest rooms.

- 2. If an economizer is required by subparagraph 1., it shall be:
 - A. Designed and equipped with controls so that economizer operation does not increase the building heating energy use during normal operation; and
 - B. Capable of providing partial cooling even when additional mechanical cooling is required to meet the remainder of the cooling load.

EXCEPTION to Section 144(e)2.A.: Systems that provide 75% of the annual energy used for mechanical heating from site-recovered energy or a site-solar energy source.

- (f) Supply Air Temperature Reset Controls. Mechanical space conditioning systems supplying heated or cooled air to multiple zones shall include controls that automatically reset supply air temperatures:

- 1. In response to representative building loads or to outdoor air temperature; and

144(f)2.-(g)

2. By at least 25% of the difference between the design supply air temperature and the design room air temperature.

Air distribution to zones that are likely to have constant loads, such as interior zones, shall be designed for the fully reset supply temperature.

EXCEPTION No. 1 to Section 144(f): Systems that meet the requirements of Section 144(d)., without using Exception No. 1 or No. 2 to that Section.

EXCEPTION No. 2 to Section 144(f): Where supply air temperature reset would increase overall building energy use.

EXCEPTION No. 3 to Section 144(f): Zones in which specific humidity levels are required to satisfy process needs.

- (g) Electric Resistance Heating. Electric resistance heating systems shall not be used for space heating.

EXCEPTION No. 1 to Section 144(g): Where an electric resistance heating system supplements a heating system in which at least 60 percent of the annual energy requirement is supplied by site-solar or recovered energy.

EXCEPTION No. 2 to Section 144(g): Where an electric resistance heating system supplements a heat pump heating system, and the heating capacity of the heat pump is more than 75% of the design heating load calculated in accordance with Sections 144(a) at the design outdoor temperature specified in 144(b)4.

EXCEPTION No. 3 to Section 144(g): Where the total capacity of all electric resistance heating systems serving the entire building is less than 10% of the total design output capacity of all heating equipment serving the entire building.

EXCEPTION No. 4 to Section 144(g): Where the total capacity of all electric resistance heating systems serving the building, excluding those allowed under Exception No. 2, is no more than 3 kW.

EXCEPTION No. 5 to Section 144(g): Where an electric resistance heating system serves an entire building that:

- I. Is not a high-rise residential or hotel/motel building; and
- II. Has a conditioned floor area no greater than 5,000 square feet; and

- III. Has no mechanical cooling; and
- IV. Is in an area where natural gas is not currently available and an extension of a natural gas system is impractical, as determined by the natural gas utility.

Section 145. Prescriptive Requirements for Service Water Heating Systems.

- (a) Nonresidential and Hotel/Motel Occupancies. A service water heating system installed in a nonresidential or hotel/motel building complies with this section if it complies with the applicable requirements of Sections 111, 113, and 123.
- (b) High-Rise Residential Occupancies. A service water heating system installed in a high-rise residential building complies with this section if it complies with Section 151(f)8.

Section 146. Prescriptive Requirements For Lighting.

A building complies with this section if its actual lighting power density calculated under subsection (a) is no greater than the allowed lighting power density calculated under subsection (b).

- (a) Calculation of Actual Lighting Power Density. The actual lighting power density of the proposed building is the total watts of all planned permanent lighting systems (including, but not limited, to track and flexible lighting systems, lighting that is integral with modular furniture, movable displays and cabinets, and internally illuminated case work for task or display purposes), minus any adjustments allowed under subsections 1. through 4.
1. Multiple Interlocked Lighting Systems Serving a Space. When multiple interlocked lighting systems serve a space, the watts of all systems except the system with the highest wattage may be excluded, if:
 - A. The lighting systems are interlocked to prevent simultaneous operation; or
 - B. The lighting systems are controlled by a preset dimming system or other device that prevents simultaneous operation of more than one lighting system, except under the direct control of authorized personnel.
 2. Reduction of Wattage Through Controls. The watts of any luminaire that is controlled may be reduced by the number of watts times the applicable factor from Table No. 1-L, if:
 - A. The control complies with Section 119; and
 - B. At least 50% of the light output of the luminaire is within the applicable space listed in Table No. 1-L; and
 - C. Except as noted in Table No. 1-L, only one power adjustment factor is used for the luminaire; and
 - D. For daylighting control credits, the luminaire is controlled by the daylighting control, and the luminaire is located within the daylit area.

**TABLE NO. 1-L
LIGHTING POWER ADJUSTMENT FACTORS**

<u>Type of Control</u>	<u>Type of space</u>	<u>Factor</u>
Occupant Sensor with separate sensor for each space	any space \leq 250 square feet enclosed by opaque floor to ceiling partitions; any size classroom, corridor, conference or waiting room	0.20
	rooms of any size that are used exclusively for storage	0.60
	greater than 250 square feet	0.10
Dimming System Manual	hotels/motels, restaurants, auditoriums, theaters	0.10
	Multi-scene programmable	hotels/motels, restaurants, auditoriums, theaters
Lumen Maintenance Controls	any space	0.10
Tuning	any space	0.10
Automatic Time Switch Control Device	< 250 square feet and with a timed manual override at each switch location required by Section 131(a), and controlling only the lights in the area enclosed by ceiling-height partitions.	0.05

<u>Type of Control</u>	<u>Type of space</u>	<u>Factor</u>
Combined Controls		
Occupant sensor with a separate sensor for each space used in conjunction with lumen maintenance controls	any space \leq 250 square feet and enclosed by opaque floor to ceiling partitions.	0.37
Occupant sensor with programmable multi-scene dimming system	hotels/motels, restaurants, auditoriums, theaters	0.35
Occupant sensor with a separate sensor for each space used in conjunction with daylighting controls and separate sensor for each space	any space \leq 250 square feet within a daylit area and enclosed by opaque floor to ceiling partitions	0.10 (may be added to daylighting control credit)

Automatic Daylighting Controls (Stepped/Dimming)

Glazing Type	Windows		
	Window Wall Ratio		
	< 20%	20% to 40%	> 40%
VLT \geq 60%	0.20/0.30	0.30/0.40	0.40/0.40
VLT \geq 35 and < 60%	0/0	0.20/0.30	0.30/0.40
VLT < 35%	0/0	0/0	0.20/0.40

Glazing Type	Skylights		
	% of Gross Exterior Roof Area		
	< 1%	1% to 3%	> 3%
VLT \geq 60%	0/0.30	0.15/0.40	0.30/0.40
VLT \geq 35 and < 60%	0/0.20	0/0.30	0.15/0.40
VLT < 35%	0/0.10	0/0.20	0/0.30

3. Lighting Wattage Excluded. The watts of the following lighting applications may be excluded from the actual lighting power density of the building:
- A. Lighting for theme parks and special effects lighting for dance floors;
 - B. Lighting for film studios;
 - C. Lighting for exhibits or for theatrical and other live performances, in exhibit, convention areas, and in hotel function areas, if the lighting is an addition to a general lighting system, and if the lighting is controlled by a multi-scene or theatrical cross-fade control station accessible only to authorized operators;
 - D. Specialized local lighting installed in non-lighting equipment by its manufacturer;
 - E. In medical and clinical buildings, examination and surgical lights, low-level night lights, and lighting integral to medical equipment;
 - F. In restaurant buildings and areas, lighting for food warming or integral to food preparation equipment;
 - G. Interior lighting in refrigerated cases;
 - H. Lighting for plant growth or maintenance, if it is equipped with an automatic 24-hour time switch that has program backup capabilities that prevent the loss of the switch's program and time setting for at least 10 hours if power is interrupted;
 - I. Lighting equipment that is for sale;
 - J. Lighting demonstration equipment in lighting education facilities;
 - K. Lighting that is required for exit signs subject to Section 1012 of the UBC, if it has an efficacy of at least 40 lumens per watt and has a power factor greater than 90%;
 - L. Exit way or egress illumination that is normally off and that is subject to Section 1013 of the UBC;

146(a)3.-4.

- M. Exit way or egress lighting whose switching is regulated by Article 3-700 of the State Electrical Code (Title 24, Part 3);
 - N. In hotel/motel buildings, lighting in guest rooms;
 - O. In high-rise residential buildings, lighting in living quarters.
 - P. The lighting system using the least wattage in a redundant lighting system interlocked or otherwise controlled to prohibit simultaneous operation of more than one lighting system.
4. Lighting Fixtures. The watts of track and other lighting fixtures that allow the substitution of low efficacy sources for high efficacy sources without altering the wiring of the fixture shall be determined by a method approved by the Commission.

- (b) Calculation of Allowed Lighting Power Density. The allowed lighting power density for each application for a building permit shall be calculated using one and only one of the methods in subsection 1., 2., or 3., as applicable.
1. Complete Building Method. The Complete Building Method may be used only on projects involving entire buildings where the applicant is applying for a lighting permit for, and submits plans and specifications for, the entire building. Under this approach, the allowed lighting power density is the lighting power density value in Table No. 1-M times the conditioned floor area of the entire building. Hotel/motel and high-rise residential buildings shall not use this method.

**TABLE NO. 1-M
COMPLETE BUILDING METHOD
LIGHTING POWER DENSITY VALUES (Watts/ft²)**

<u>Type of use</u>	<u>Allowed Lighting Power</u>
General Commercial and Industrial	
Work Buildings	1.2
Grocery Store	1.8
Industrial and Commercial	
Storage Buildings	0.8
Medical Buildings and Clinics	1.5
Office Building	1.5
Religious Worship, Auditorium, and	
Convention Centers	2.0
Restaurants	1.5
Retail and Wholesale Store	2.0
Schools	1.8
Theaters	1.5
All Others	0.8

146(b)2.

2. Area Category Method. Under the Area Category Method, the total allowed lighting power for the building is the sum of all allowed lighting powers for all areas in the building. For purposes of the Area Category Method, an "Area" shall be defined as all contiguous spaces which accommodate or are associated with a single one of the primary functions listed in Table No. 1-N. Where areas are bounded or separated by interior partitions, the floor space occupied by those interior partitions shall not be included in any area. When the Area Category Method is used to calculate the allowed total lighting power for an entire building, main entry lobbies, corridors, restrooms, and support functions shall be treated as separate areas.

TABLE NO. 1-N

**AREA CATEGORY METHOD - LIGHTING POWER
DENSITY VALUES (Watts/ft²)**

<u>Primary Function</u>	<u>Allowed Lighting Power</u>
Auditorium	2.0*
Bank/Financial Insitution	1.8
Classrooms	2.0
Convention, Conference and Meeting Centers	1.6
Corridors, Restrooms and Support Areas . .	0.8
Dining	1.2
Exhibit	2.3
General Commercial and Industrial Work .	1.3
Grocery	2.0
Hotel Function	2.3*
Industrial and Commercial Storage	0.6
Kitchen	2.2
Lobbies:	
Hotel Lobby	2.3*
Main Entry Lobby	1.6*
Malls, Arcades, and Atria	1.2*
Medical and Clinical Care	1.8
Office	1.6
Precision Commercial and/or Industrial Work	2.0
Religious Worship	2.2*
Retail Sales, Wholesale Showrooms	2.2
Theaters	
Motion Picture	1.0
Performance	1.5*

* The smallest of the following values may be added to the allowed lighting power listed in Table No. 1-N, for ornamental chandeliers and sconces that are switched or dimmed on circuits different from the circuits for general lighting:

- a. 20 watts per cubic foot times the volume of the chandelier or sconce;
or
- b. 1 watt per square foot times the area of the task space that the chandelier or sconce is in; or
- c. the actual design wattage of the chandelier or sconce.

3. Tailored Method. Under the Tailored Method, the allowed lighting power density shall be calculated as specified in subparagraphs (b)3.A. through (b)3.I. Figure No. 1-B provides a flow chart of the calculations.

**FIGURE NO. 1-B
DETERMINING ALLOCATIONS WITHIN
THE TAILORED METHOD IN
SECTION 146(b)3**

<u>Step</u>	<u>Illuminance Category</u>	
	A - D	E - I
	See the following subparagraphs	
Determine Illuminance Categories for Each Space	(b)3.A	(b)3.A
Determine LPD Value for Each Space	(b)3.B	(b)3.C
Determine Area of Each Space	(b)3.D	(b)3.D
Determine Total Watts for Each Space	(b)3.E	(b)3.F
Determine Allowed Watts for Each Space	(b)3.G	(b)3.G
Determine Additional Allotments Allowed	(b)3.H	(b)3.H
Determine Allowed Power Density of the Building	(b)3.I	(b)3.I

- A. Determine the illuminance category of each task space according to Table No. 1-T, or, if the task is not listed in the table, according to the IES Handbook, Applications Volume (1987 ed.). Selection of each illuminance category shall be justified on the plans submitted under Section 10-103 of Title 24, Part 1. Categories E through I may be used only if the plans submitted under Section 10-103 of Title 24, Part 1 clearly identify all task spaces for such categories and the lighting designed to illuminate them.

TABLE NO. 1-T
ILLUMINANCE CATEGORIES FOR TASKS

<u>Task Area</u>	<u>Illuminance Category</u>
Dining	D
Office	D*
Public Area Displays	G
Sales Feature Displays	G

* Office Lighting American National Standard Practice ANSI/IES RP-1, 1982 shall be used to determine the illuminance category for each office task area that requires an illuminance level higher than D. The illuminance category for visual task requirements selected for each office task area shall not be based on:

- a. poor quality tasks that can be improved; or
 - b. tasks that are performed for less than two hours per day.
- B. Determine the lighting power density value of each task space for categories A through D according to Table No. 1-R.
- C. Determine the lighting power density value of each task space for categories E through I according to Table No. 1-R.
- D. Determine the area, in square feet and as measured from the inside of interior partitions, of each task space that has a separate illuminance requirement. The illuminance category of the following spaces shall be limited as stated:
- i. Gross Sales Floor Area. The gross sales floor area shall be no more than 2.2 watts per square foot, plus the allocation for sales feature floor displays.
 - ii. Sales Feature Floor Displays. Illuminance category G may be used for no more than 10% of the gross sales floor area of the building.

EXCEPTION to Section 146(b)3.D.ii.: For sales feature floor display lighting in stores with less than 800 square feet of gross sales area, 1000 watts may be used.

- iii. Gross Sales Wall Area. Gross sales wall areas shall be no more than 2.2 watts per square foot, plus the allocation for sales feature wall displays.
 - iv. Sales Feature Wall Displays. Illuminance category G may be used for no more than 10% of the gross sales wall area.
 - v. Private Offices and Work Areas. Illuminance category E may be used for up to 50% of the actual private office or work area; the rest of the private office or work area shall be no more than 0.5 watts per square foot.
 - vi. Public Area Displays. Illuminance category G may be used for no more than 10% of the public display area of the building.
- E. Multiply the lighting power density value of each task space for illuminance categories A through D (from B) times the area of each task space (from D). For tasks where luminaires must be at or above 15 foot mounting height, the result may be multiplied by the applicable figure from Table No. 1-P.
- F. Multiply the lighting power density value of each task space for illuminance categories E through I (from C) times the area of each task space (from D). For tasks where luminaires must be at or above 15 foot mounting height, the result may be multiplied by the applicable figure from Table No. 1-P.

**TABLE NO. 1-P
MOUNTING HEIGHT MULTIPLIERS**

<u>Required Mounting Height (feet)</u>	<u>Multiplier</u>
15	1.15
16	1.21
17	1.47
18	1.65
19	1.84
20 or more	2.04

- G. For each task space, choose the smaller of:
- the result in E. plus the result in F.; or
- the result in E. plus the actual design watts of the lighting equipment used for task spaces for illuminance categories E through I and the gross sales wall area.
- H. The values obtained in G. may be increased by the following:
- i. Very Valuable Merchandise. For lighting of very valuable merchandise, the smaller of:

20 watts per square foot times the area of lighted case top; or

the actual design wattage of the lighting equipment for the merchandise.
 - ii. Ornamental Chandeliers and Sconces. For ornamental chandeliers and sconces in performance theater, religious worship, auditorium, mall, hotel function area, and lobby occupancy types, the smaller of:

20 watts per cubic foot times the volume of the chandelier or sconce; or

1 watt per square foot times the area of the task space that the chandelier or sconce is in; or

the actual design wattage of the chandelier or sconce.
- I. Add the results in G. for all task spaces in the building plus the additional watts allowed in H. The result is the allowed lighting power of the building under the Tailored Method.

**TABLE NO. 1-R
ILLUMINANCE CATEGORIES A - I
LIGHTING POWER DENSITY VALUES (Watts/ft²)**

<u>Illuminance category</u>	<u>Room cavity ratio</u>		
	0 < 3.5	≥3.5 to < 7	≥ 7+
A	.2	.3	.4
B	.4	.5	.8
C	.6	.8	1.2
D	1.2	1.5	1.8
E	2.8	3.6	4.7
	Task area ≤ 2 ft ² or Throw distance > 8 ft		Task area > 2 ft ² and Throw distance ≤ 8 ft
F	10		5
G	26		13
H	63		33
I	130		65

Section 147. [Reserved]

Section 148. [Reserved]

**SUBCHAPTER 6 (SECTION 149):
NONRESIDENTIAL, HIGH-RISE RESIDENTIAL, AND HOTEL/MOTEL
OCCUPANCIES -- ADDITIONS, ALTERATIONS, AND REPAIRS**

Section 149. Additions, Alterations, and Repairs to Existing Nonresidential, High-Rise Residential, and Hotel/Motel Buildings.

(a) Additions. Additions shall meet either 1 or 2 below.

1. Prescriptive Approach. The envelope and lighting of the addition, and any newly installed space conditioning or water heating system serving the addition, shall meet the applicable requirements of Sections 110 through 139 and 142 through 146.
2. Performance Approach.
 - A. The envelope and lighting of the addition, and any newly installed space conditioning or water heating system serving the addition, shall meet the applicable requirements of Sections 110 through 139; and
 - B. Either:
 1. The addition alone shall comply with Section 141; or
 2. The energy efficiency of the existing building shall be improved so that the entire building meets the energy budget in Section 141 that would apply to the entire building, if the existing building was unchanged and the addition alone complied with 1.

EXCEPTION No. 1 to Section 149(a): When heating, cooling, or service water heating to an addition are provided by expanding existing systems, the existing systems and equipment need not comply with Sections 110 through 129 or 144 through 145.

EXCEPTION No. 2 to Section 149(a): Where an existing system with electric reheat is expanded by adding variable air volume (VAV) boxes to serve an addition, total electric reheat capacity may be expanded not to exceed 50 percent of the existing installed electric heating capacity in any one permit and the system need not comply with Section 144(g). Additional electric reheat capacity in excess of 50 percent may be added subject to the requirements of the Section 144(g).

149 (b)1.-2.

(b) Alterations. Alterations not subject to subsection (a) shall meet either 1 or 2 below.

1. Prescriptive Approach. The altered envelope, space conditioning, lighting, and water heating components, and any newly installed equipment serving the alteration, shall meet the applicable requirements of Sections 110 through 139; and

A. Alterations to the building envelope shall:

i. Neither increase the overall heat gain nor increase the overall heat loss of the building envelope for which a permit is sought; or

ii. Meet the requirements of Section 143; and

B. New space conditioning systems shall meet the requirements of Section 144; and

C. New lighting systems installed in conjunction with an increase in conditioned floor area, such as adding a mezzanine, shall meet the requirements of Section 146; and

D. Alterations to existing lighting systems that increase the connected lighting load or replace more than 50% of the lighting fixtures shall meet the requirements of Section 146; and

E. New service water heating systems shall meet the requirements of Section 145.

2. Performance Approach.

A. The altered envelope, space conditioning, lighting, and water heating components, and any newly installed equipment serving the alteration, shall meet the applicable requirements of Sections 110 through 139; and

B. Either:

i. The permitted space alone shall comply with Section 141; or

- ii. The energy efficiency of the existing building shall be improved so that the entire building meets the energy budget in Section 141 that would apply to the entire building, if the existing building was unchanged and the permitted space alone complied with i.

EXCEPTION No. 1 to Section 149(b): When heating, cooling, or service water heating for an alteration are provided by expanding existing systems, the existing systems and equipment need not comply with Sections 110 through 129 and Sections 144 or 145.

EXCEPTION No. 2 to Section 149(b): When existing heating, cooling, or service water heating systems or components are moved within a building, the existing systems or components need not comply with Sections 110 through 129 and Sections 144 or 145.

EXCEPTION No. 3 to Section 149(b): Where an existing system with electric reheat is expanded when adding variable air volume (VAV) boxes to serve an alteration, total electric reheat capacity may be expanded not to exceed 20 percent of the existing installed electric capacity in any one permit and the system need not comply with Section 144(g). Additional electric reheat capacity in excess of 20 percent may be added subject to the requirements of the Section 144(g).

- (c) Repairs. Repairs shall not increase the preexisting energy consumption of the repaired component, system, or equipment.
- (d) Alternate Method of Compliance. Any addition, alteration, or repair may comply with the requirements of Title 24, Part 6 by meeting the applicable requirements for the entire building.

150(a)-(c)1.

**SUBCHAPTER 7 (SECTION 150):
LOW-RISE RESIDENTIAL BUILDINGS -- MANDATORY FEATURES AND
DEVICES**

Section 150. Mandatory Features and Devices

Any new low-rise residential building shall meet the requirements of this Section.

(a) Ceiling Insulation. The opaque portions of ceilings separating conditioned spaces from unconditioned spaces or ambient air shall meet the requirements of either 1 or 2 below:

1. Ceilings shall be insulated between wood framing members with insulation resulting in an installed thermal resistance of R-19 or greater for the insulation alone.

ALTERNATIVE to Section 150(a)1.: Insulation which is not penetrated by framing members may meet an R-value equivalent to installing R-19 insulation between wood framing members and accounting for the thermal effects of framing members.

2. The weighted average U-value of ceilings shall not exceed the U-value that would result from installing R-19 insulation between wood framing members in the entire ceiling and accounting for 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 weight per square foot at the manufacturer's labeled R-value.

(c) Wall Insulation. The opaque portions of frame walls separating conditioned spaces from unconditioned spaces or ambient air 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-13 or greater. Framed 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 at least R-13.

ALTERNATIVE to Section 150(c)1.: Insulation which is not penetrated by framing members may meet an R-value equivalent to installing R-13 insulation between wood framing members and accounting for the thermal effects of framing members.

2. The weighted average U-value of walls shall not exceed the U-value that would result from installing R-13 insulation between wood framing members and accounting for the effects of framing members.
- (d) Raised Floor Insulation. Concrete raised floors over unconditioned space shall be insulated to an installed thermal resistance of at least R-8. All other raised floors separating conditioned space from unconditioned space shall meet the requirements of either 1 or 2 below:
1. Floors shall be insulated between wood framing members with insulation having an installed thermal resistance of R-13 or greater.
 2. The weighted average U-value of floor assemblies shall not exceed the U-value that would result from installing R-13 insulation between wood framing members and accounting for the effects of framing members.

ALTERNATIVE to Section 150(d) 1. and 2.: Raised floor insulation may be omitted if the foundation walls are insulated to meet the wall insulation minimums shown in Tables No. 1-Z1 through 1-Z16, a vapor barrier is placed over the entire floor of the crawl space, and vents are fitted with automatically operated louvers that are temperature actuated.

- (e) Installation of Fireplaces, Decorative Gas Appliances, and Gas Logs.
1. If a masonry or factory-built fireplace is installed, it shall have the following:
 - A. Closable metal or glass doors covering the entire opening of the firebox;
 - B. A combustion air intake to draw air from the outside of the building directly into the firebox, which is at least 6-square inches in area and is equipped with a readily accessible, operable, and tight-fitting damper or combustion air control device; and

150(e)1.-(h)1.

EXCEPTION to Section 150(e)1.B.: An outside combustion air intake is not required if the fireplace will be installed over concrete slab flooring and the fireplace will not be located on an exterior wall.

C. A flue damper with a readily accessible control.

EXCEPTION to Section 150(e)1.C.: When a gas log, log lighter, or decorative gas appliance is installed in a fireplace, the flue damper shall be blocked open if required by the manufacturer's installation instructions or the California Mechanical Code.

2. 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.

(f) Infiltration Barriers. If an infiltration barrier is installed to meet the requirements of Section 151, it must have an air porosity of less than 5 ft³ per hour per square foot per inch of mercury pressure difference when tested in accordance with the requirements of ASTM E-283-84. If a vapor barrier functions as an infiltration barrier it shall be located on the conditioned side of the exterior framing.

(g) Vapor Barriers. In Climate Zones 14 and 16 shown in Figure No. 1-A, 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.

If a building has a control ventilation crawl space, a vapor barrier shall be placed over the earth floor of the crawl space to reduce moisture entry and protect insulation from condensation, as specified in the ALTERNATIVE to Section 150(d).

(h) Space Conditioning Equipment.

1. Building design heat loss rate and design heat gain rate, shall be determined using a method based on any one of the following:

A. The American Society of Heating, Refrigeration, and Air-Conditioning Engineers (ASHRAE) Handbook and Product Directory, Equipment Volume (1988), Systems and Applications Volume (1987), and Fundamentals Volume (1989), or

- B. The Sheet Metal Air Conditioning Contractors National Association (SMACNA) Load Calculation Manual, or
- C. The Air Conditioning Contractors Of America (ACCA) Manual J.

The design heat loss rate and design heat gain rate are two of the criteria that shall be used for equipment sizing and selection.

NOTE to Section 150(h)1.: Heating Systems must meet the minimum heating capacity required by UBC Section 310.11. The furnace output capacity and other specifications are published in the Commission's directory of certified equipment or other directories approved by the Commission.

2. Design Conditions.

For the purpose of sizing the space conditioning (HVAC) system, the indoor design temperatures shall be 70 degrees Fahrenheit for heating and 78 degrees for cooling. The outdoor design temperatures shall be those listed in the 0.2 percent Winter Dry Bulb column for heating and the 0.5 percent Summer Dry Bulb and the 0.5 percent Wet Bulb columns for cooling, based on percent-of-year in ASHRAE publication *SPPCDX: Climate Data for Region X, Arizona, California, Hawaii, and Nevada*, 1982.

- (i) Setback Thermostats. All heating and/or cooling systems other than wood stoves shall have an automatic thermostat with a clock mechanism or other setback mechanism approved by the Executive Director that shuts the system off during periods of non-use and that allows the building occupant to automatically set back the thermostat set points for at least 2 periods within 24 hours.

EXCEPTION to Section 150(i): Gravity gas wall heaters, gravity floor heaters, gravity room heaters, non-central electric heaters, room air conditioners, and room air conditioner heat pumps need not comply with this requirement. Additionally, room air conditioner heat pumps need not comply with Section 112(b). The resulting increase in energy use due to elimination of the setback thermostat shall be factored into the compliance analysis in accordance with a method prescribed by the Executive Director.

150(j) TABLE NO. 1-S

(j) Pipe and Tank Systems.

1. Unfired hot water tanks, such as storage tanks and backup storage tanks for solar water heating systems, shall be externally wrapped with insulation having an installed thermal resistance of R-12 or greater or have internal insulation of at least R-16 and a label on the exterior of the tank showing the insulation R-value.
2. Piping, whether buried or unburied, for recirculating sections of domestic hot water systems, piping from the heating source to the storage tank for an indirect-fired domestic water heating system, cooling system piping below 55 degrees Fahrenheit, and the first five feet of hot and cold water pipes from the storage tank for non-recirculating systems shall be thermally insulated in accordance with Table No. 1-S.

TABLE NO. 1-S
Pipe Insulation Requirements
Minimum R-Value

<u>System</u>	<u>Pipe Diameter</u>	
	<u>Less than or equal to 2"</u>	<u>Greater than 2"</u>
Domestic Hot Water	R-4	R-6
Hydronic Heating Supply Lines	R-4	R-6
Cooling Systems (pipes below 55°F)	R-3	R-4

EXCEPTIONS to Section 150(j)2.: The following piping does not have to be thermally insulated: (1) factory-installed piping within space conditioning equipment; and (2) piping that conveys fluids that have a design operating temperature range between 55 degrees and 105 degrees Fahrenheit.

NOTE to Section 150(j)2.: Where the Executive Director approves a water heater calculation method for a particular water heating recirculation system, piping insulation requirements shall be those specified in the approved calculation method.

3. Solar water heating systems and/or collectors shall be certified by the Solar Rating and Certification Corporation.

(k) Lighting.

1. Luminaires for general lighting in kitchens shall have lamps with an efficacy of not less than 40 lumens per watt. A luminaire which is the only lighting in a kitchen will be considered general lighting. General lighting shall be controlled by the most accessible switch(es) in the kitchen.

Additional luminaires to be used only for specific decorative effects need not meet this requirement.

2. Each room containing a water closet shall have at least one luminaire with lamps with an efficacy of not less than 40 lumens per watt. If there is more than one luminaire in the room, the high efficacy luminaire shall be switched at an entrance to the room.

ALTERNATIVE to Section 150(k)2.: The efficacy requirement may be met by installing the luminaire meeting this requirement in an adjacent room that has complementary plumbing fixtures.

3. Luminaires installed to meet the 40 lumens per watt requirements of Section 150(k) 1. or 2. shall not contain medium base incandescent lamp sockets, and shall be on separate switches from any incandescent lighting.
4. All incandescent lighting fixtures recessed into insulated ceilings shall be approved for zero-clearance insulation cover (I.C.) by Underwriters Laboratories or other testing/rating laboratories recognized by the International Conference of Building Officials.

(l) Slab Edge Insulation. Material used for slab edge insulation shall meet the following minimum specifications:

1. Water absorption rate no greater than 0.3 percent when tested in accordance with ASTM-C-271.
2. Water vapor permeance no greater than 2.0 perm/inch when tested in accordance with ASTM-E-96-90.

150(l)3.-(m)5.

3. Concrete slab perimeter insulation must be protected from physical damage and ultra violet light deterioration.

(m) Ducts and Fans.

1. Air handling duct systems shall be installed and sealed to meet the requirement of UMC Sections 601 and 603. Portions conveying conditioned air shall either be insulated to a minimum installed level of R-4.2 (or any higher level required by UMC Section 604) or be enclosed entirely in conditioned space.
2. All duct insulation product R-values shall be based on insulation only (excluding air films, vapor barriers, or other duct components) and tested C-values at 75°F mean temperature at the installed thickness, in accordance with ASTM C518-85 or ASTM C177-85, and certified pursuant to Section 118.
3. The installed thickness of duct insulation used to determine its R-value shall be determined as follows:
 - A. For duct board, duct liner and factory-made rigid ducts not normally subjected to compression, the nominal insulation thickness shall be used.
 - B. For duct wrap, installed thickness shall be assumed to be 75 percent (25 percent compression) of nominal thickness.
 - C. For factory-made flexible air ducts, the installed thickness shall be determined by dividing the difference between the actual outside diameter and nominal inside diameter by 2.
4. Insulated flexible duct products installed to meet this requirement must include labels, in maximum intervals of 10 feet, showing the thermal performance R-value for the duct insulation itself (excluding air films, vapor barriers, or other duct components), based on the tests in Section 150(m)2. and the installed thickness determined by Section 150(m)3.C.
5. All fan systems, regardless of volumetric capacity, that exhaust air from the building to the outside shall be provided with backdraft or automatic dampers to prevent air leakage.

6. All gravity ventilating systems that serve conditioned space shall be provided with either automatic or readily accessible, manually operated dampers in all openings to the outside except combustion inlet and outlet air openings and elevator shaft vents.

EXCEPTION to Section 150(m)1.: The requirements do not apply to ducts and fans integral to a wood heater or fireplace.

[NOTE: Authority cited: Public Resources Code, Section 25218(e), 25402, 25402.1. Reference: Public Resources Code, Section 25402.]

151(a)-(b)1.

**SUBCHAPTER 8 (SECTION 151):
LOW-RISE RESIDENTIAL BUILDINGS -- PERFORMANCE AND
PRESCRIPTIVE COMPLIANCE APPROACHES**

Section 151. Performance and Prescriptive Compliance Approaches

(a) Basic Requirements. New low-rise residential buildings shall meet all of the following:

1. The requirements of Sections 111 through 118 applicable to new residential buildings.
2. The requirements of Section 150 (mandatory features).
3. Either the performance standards (energy budgets) or the prescriptive standards (alternative component packages) set forth in this section for the climate zone in which the building will be located. Climate zones are shown in Figure No. 1-A.

ALTERNATIVE to Section 151(a)3.: If a single contiguous subdivision or tract falls in more than one climate zone, all buildings in the subdivision or tract may be designed to meet the performance or prescriptive standards for the climate zone which contains 50 percent or more of the dwelling units.

NOTE to Section 151(a)3.: The California Energy Commission shall periodically update, publish and make available to interested persons and local building departments a document entitled *California Climate Zone Descriptions for New Buildings* (July 1995), which shall contain a precise description of the metes and bounds for climate zone boundaries depicted in Figure No. 1-A and a list of the communities in each zone.

4. For other provisions applicable to new low-rise residential buildings, refer to Section 100(c).

(b) Performance Standards. A building complies with the performance standard if its combined calculated depletable energy use for water heating (Section 151(b)1.) and space conditioning (Section 151(b)2.) is less than or equal to the combined maximum allowable energy use for both water heating and space conditioning, even if the building fails to meet either the water heating or space conditioning budget alone.

1. Water heating budgets. The budgets for water heating systems are those calculated from Equation No. 1-N.

**EQUATION NO. 1-N
ANNUAL WATER HEATING BUDGET (AWB):**

For dwelling units less than 2500 ft²:

$$\text{AWB (kBtu/yr.-ft}^2\text{)} = \frac{(14000)}{\text{CFA}} + 4.85$$

For dwelling units equal to or greater than 2500 ft²:

$$\text{AWB (kBtu/yr.-ft}^2\text{)} = \frac{(26125)}{\text{CFA}}$$

Where CFA = the building's conditioned floor area in square feet.

The annual water heating budget calculated from Equation No. 1-N may be met by either:

- A. Calculating the energy consumption of the proposed water heating system using an approved calculation method or
 - B. Installing any gas storage type non-recirculating water heating system that does not exceed 50 gallons of capacity, meets the minimum standards specified in the Appliance Efficiency Standards, and either has an R-12 external insulation wrap or has been determined by the Commission to meet the annual water heating budget calculated from Equation No. 1-N without an external insulation wrap.
2. Space conditioning budgets. The space conditioning budgets for each climate zone shall be the calculated consumption of energy from depletable sources required for space conditioning in buildings in which the basic requirements of Section 151(a) and the measures in alternative component package D or E are installed. To determine the space conditioning budget, use an approved calculation method.

151(c)-2.

(c) Compliance Demonstration Requirements for Performance Standards. The application for a building permit shall include documentation which demonstrates, using an approved calculation method, that the new building has been designed so that its energy use from depletable energy sources does not exceed the combined water heating and space conditioning energy budgets for the appropriate climate zone.

1. To demonstrate compliance, the applicant's documentation shall:
 - A. Determine the combined energy budget for the proposed building by adding the following:
 - I. The annual water heating budget calculated from Equation No. 1-N (kBtu/yr.-ft²) and
 - II. The annual space conditioning budget (kBtu/yr.-ft²) as determined pursuant to Section 151(b)2.
 - B. Calculate the source energy consumption total of the proposed building, using the proposed building's actual glazing area, orientation, and distribution, and its actual energy conservation and other features, including the actual water heating, space conditioning equipment and duct conditions and locations.

Include in the calculation the energy required for building cooling even if the building plans do not indicate that air conditioning will be installed.
2. The proposed building design complies if the energy consumption calculated pursuant to Section 151(c)1.B is equal to or less than the combined energy budget established in Section 151(c)1.A.

MULTIPLE ORIENTATION ALTERNATIVE to Section 151(c): A permit applicant may demonstrate compliance with the energy budget requirements of Section 151(a) and (b) for any orientation of the same building model, if the documentation demonstrates that the building model with its proposed designs and features would comply in each of the four cardinal orientations.

In the four compliance demonstrations, all designs and features must be the same, except that a model may differ in its shading in order to show compliance in the four cardinal directions.

(d) Compliance Methods for Performance Standards.

Compliance with the energy budget requirements of 151(a)3 and (b) must be demonstrated either by:

1. Using a point system approved by the Commission, including any computer programs approved by the Executive Director that are based on an approved point system; or
2. Using the compliance version of the Commission's Public Domain Computer Program or any alternative calculation method approved by the Commission for use in complying with Section 151(a) and (b).

NOTE to Section 151(d): Compliance with the water heating budget need not be demonstrated using any of the calculation methods referred to in Section 151(d), if all the requirements of Section 151(b)1.B are met.

(e) Required Calculation Assumptions. The Commission shall publish the assumptions and calculation methods it used to develop the standards for low-rise residential buildings, including those specified in Section 151. In determining the water heating and space conditioning budgets and calculating the energy use of the proposed building design, the applicant shall use only these assumptions and calculation methods (or alternative assumptions and methods approved by the Commission or its Executive Director).

1. Such assumptions shall include, but not be limited to, the following:
 - A. The operating conditions regarding indoor temperature; occupancy loads and schedules; equipment loads and operation schedules, including lighting, HVAC, and miscellaneous electrical; and outdoor weather conditions;
 - B. The physical characteristics of building pressurization, interior heat transfer, film coefficients, shading coefficient and operation of installed shading devices, ground temperatures, and the method of determining slab heat loss;
 - C. The applicable modeling procedures for the assumptions, design conditions, and physical characteristics described in Section 151(e)1.

151(e)1.-(f)

EXCEPTION to Section 151(e)1: The Commission may approve alternative schedules, assumptions, and performance modeling procedures that may be used in lieu of those described in Section 151(e)1, provided such alternatives do not alter the efficiency level required by these standards.

2. The total calculated annual energy consumption shall include all energy used for comfort heating, comfort cooling, ventilation for the health and comfort of occupants, and service water heating.
 3. Heat transfers within the same building to adjacent spaces that are not covered by the permit and that are independently provided with space conditioning may be considered to be zero. Heat transfers to spaces not yet provided with space conditioning may be modeled as separate unconditioned zones, or as outdoor conditions.
 4. The total calculated annual energy consumption need not include energy from any nondepletable sources, regardless of the purpose of the energy consumed.
 5. The U-value of installed manufactured fenestration products shall be those certified by an approved independent certification organization in accordance with Section 116. The U-value of site-built fenestration products shall be those published by the Commission, based on an approved method that determines the area weighted average U-value for generic types of products.
 6. Shading coefficients for interior devices used with fenestration products shall be taken from Tables 25, 26, and 27 of Chapter 27 of the ASHRAE Handbook of Fundamentals (1989), except that the minimum shading coefficient that shall be assumed for any interior shading device is 0.40.
- (f) Prescriptive Standards/Alternative Component Packages. Buildings that comply with the prescriptive standards shall be designed, constructed and equipped to meet all of the requirements of one of the alternative packages of components shown in Tables No. 1-Z1 through 1-Z16 for the appropriate climate zone shown in Figure No. 1-A. Installed components shall meet the following requirements:

1. Insulation.

- A. Ceiling, wall, slab floor perimeter, and raised floor insulation shall be installed which has an R-value equal to or higher than that shown in Tables No. 1-Z1 through 1-Z16. The minimum opaque ceiling, wall (including heated basements and crawl spaces), and raised floor R-values shown are for insulation installed between wood framing members.

ALTERNATIVE to Section 151(f)1.A: The insulation requirements of Tables No. 1-Z1 through 1-Z16 may also be met by ceiling, wall, or floor assemblies that meet equivalent minimum R-values that consider the effects of all elements of the assembly, using a calculation method approved by the Executive Director.

EXCEPTION to Section 151(f)1.A: Raised floor insulation may be omitted if the foundation walls are insulated to meet the wall insulation minimums shown in Tables No. 1-Z1 through 1-Z16, a vapor barrier is placed over the entire floor of the crawl space, and the vents are fitted with automatically operated louvers.

- B. The minimum depth of concrete-slab floor perimeter insulation shall be 16 inches or the depth of the footing of the building, whichever is less.

EXCEPTION to Section 151(f)1.B: Perimeter insulation is not required along the slab edge between conditioned space and the concrete slab of an attached unconditioned enclosed space, covered porches, or covered patios.

2. Glazing.

- A. Installed fenestration products shall have U-values equal to or lower than those shown in Tables No. 1-Z1 through 1-Z16. The U-value of installed fenestration products shall be determined pursuant to Section 151(e)5.
- B. Total glazing area shall not exceed the percentage of conditioned floor area specified in Tables No. 1-Z1 through 1-Z16.

- C. For Package A, the south-facing glazing area percentage (glass area/conditioned floor area) shall not be less than the percentage in Tables No. 1-Z1 through 1-Z16. South-facing glazing includes glazing in ceilings which is horizontal, tilted to the south, or tilted in any other direction at a pitch less than 1:12. North, east and west-facing glazing includes glazing in ceilings which is tilted at a pitch of 1:12 or greater to the north, east and west, respectively.
3. Shading. Where Tables No. 1-Z1 through 1-Z16 require a combined shading coefficient of 0.40 or lower for south-facing, east-facing, or west-facing shading, the requirements shall be met by either:
- A. A fenestration product listed by the manufacturer to have the required shading coefficient; or
 - B. An exterior operable louver or other exterior shading device that meets the required shading coefficient; or
 - C. An interior shading device that meets the required shading coefficient pursuant to Section 151(e)6., provided that dual glazing or better is installed.
 - D. The shading requirements for south-glazing may also be met by optimal overhangs installed so that the south-facing glazing is fully shaded at solar noon on August 21 and substantially exposed to direct sunlight at solar noon on December 21.

Except where the UBC requires emergency egress, exterior shading devices must be permanently attached to the outside of the structure with fasteners that require additional tools to remove (as opposed to clips, hooks, latches, snaps or ties).

4. Thermal Mass. Thermal mass required for Packages A, C, D, and E in Tables No. 1-Z1 through 1-Z16 shall meet or exceed the minimum interior mass capacity specified in Table No. 1-U.

TABLE NO. 1-U
Interior Mass Capacity Requirements
for Packages A, C, D, and E

Package	Minimum Interior Mass Capacity
A	35.9 X South Glazing Area (ft ²)
C (slab floor)	2.36 X Ground Floor Area (ft ²)
D	2.36 X Ground Floor Area (ft ²)
C (raised floor)	0.18 X Ground Floor Area (ft ²)
E	0.18 X Ground Floor Area (ft ²)

The mass requirements in Table No. 1-U may be met by calculating the combined interior mass capacity of the mass materials using Equation No. 1-P.

EQUATION NO. 1-P
CALCULATION OF INTERIOR MASS CAPACITY

$$\text{IMC} = [(A_1 \times \text{UIMC}_1) + (A_2 \times \text{UIMC}_2) \dots + (A_n \times \text{UIMC}_n)]$$

Where,

A_n = Area of mass material n, and

UIMC_n = Unit Interior Mass Capacity of mass material n

NOTE: The Commission's Residential Manual shall list the Unit Interior Mass Capacity (UIMC) of various mass materials.

5. Continuous Infiltration Barrier. Continuous infiltration barriers required in Tables No. 1-Z1 through 1-Z16 shall be installed over the inside face of framing in ceilings and over the inside or outside face of framing 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 building envelope for 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. Air-to-Air Heat Exchanger. The air-to-air heat exchanger required in Tables No. 1-Z1 through 1-Z16 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.

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.

7. Heating System Type. Heating system types shall be installed as required in Tables No. 1-Z1 through 1-Z16. A gas heating system is a natural or liquefied petroleum gas heating system. All supply ducts shall either be in conditioned space or be insulated to a minimum installed level of R-4.2.
8. Water Heating Systems. All water heating systems must meet the water heating budgets calculated from Equation No. 1-N.

NOTE to Section 151(f)8.: Any gas type domestic water heater of 50 gallons or less, which is certified as meeting the Appliance Efficiency Standards, and which either has an R-12 external wrap, or has been determined by the Commission to meet the annual water heating budget without an external insulation wrap may be assumed to meet the water heating budget.

9. Setback Thermostats. All heating systems shall have an automatic thermostat with a clock mechanism or other setback mechanism approved by the Executive Director which the building occupant can manually program to automatically set back the thermostat set points for at least 2 periods within 24 hours. The exception to Section 150(i) shall not apply to any heating system installed in conjunction with the packages specified in Tables No. 1-Z1 through 1-Z16.

**TABLE NO. 1-Z1
ALTERNATIVE COMPONENT PACKAGES
FOR CLIMATE ZONE 1**

Component	A	B	PACKAGE		
			C ¹¹	D	E
BUILDING ENVELOPE					
Insulation Minimums ¹					
Ceiling	R30	R30	R49	R38	R38
Wood Frame Walls	R19	R19	R29	R21	R21
"Heavy Mass" Walls	(R8.5)	(R5.0)	NA	(R4.76)	(R4.76)
"Light Mass" Walls	[R8.5]	[R6.0]	NA	NA	NA
Slab Floor Perimeter	R7	R7	R7	NR	NR ²
Raised Floor	R19	R19	R30	R19 ³	R19
GLAZING					
Maximum U-value ¹²	0.65	0.65	0.40	0.65	0.65
Maximum Total Area	NR	16%	14%	16%	16%
Maximum Total Nonsouth					
Facing Area	9.6%	NR	NR	NR	NR
Minimum South Facing Area	6.4%	NR	NR	NR	NR
SHADING COEFFICIENT⁴					
South Facing Glazing	NR	NR	0.66	0.66	0.66
West Facing Glazing	NR	NR	0.66	0.66	0.66
East Facing Glazing	NR	NR	0.66	0.66	0.66
North Facing Glazing	NR	NR	0.66	0.66	0.66
THERMAL MASS⁵					
	REQ	NR	REQ	20%	5%
INFILTRATION CONTROL					
Continuous Barrier	NR	REQ	NR	NR	NR
Air-to-Air Heat Exchanger	NR	REQ	NR	NR	NR
SPACE HEATING SYSTEM⁶					
Electric Resistant Allowed	NO	NO	YES ⁷	NO	NO
If Gas, AFUE =	78%	78%	78%	78%	78%
If Heat Pump,					
Split System HSPF ⁸ =	6.8	6.8	6.8	6.8	6.8
Single Package System HSPF =	6.6	6.6	6.6	6.6	6.6
SPACE COOLING SYSTEMS					
If Split System A/C, SEER =	10.0	10.0	10.0	10.0	10.0
If Single Package A/C, SEER ⁹ =	9.7	9.7	9.7	9.7	9.7
DOMESTIC WATER HEATING TYPE					
System must meet budget, see 151(b)1 and 151(f)(8)	ANY	ANY	ANY ¹⁰	ANY	ANY

LEGEND: NR = Not Required; NA = Not Applicable; REQ = Required

SEE NOTES FOLLOWING TABLE NO. 1-Z16

TABLE NO. 1-Z2 ACPS

TABLE NO. 1-Z2
ALTERNATIVE COMPONENT PACKAGES
FOR CLIMATE ZONE 2

Component	PACKAGE				
	A	B	C ¹¹	D	E
BUILDING ENVELOPE					
Insulation Minimums ¹					
Ceiling	R30	R30	R 49	R30	R30
Wood Frame Walls	R13	R19	R29	R13	R13
"Heavy Mass" Walls	(R2.3)	(R2.2)	NA	(R2.44)	(R2.44)
"Light Mass" Walls	[R4.5]	[R4.5]	NA	NA	NA
Slab Floor Perimeter	R7	R7	R7	NR	NR ²
Raised Floor	R13	R19	R30	R19 ³	R19
GLAZING					
Maximum U-value ¹²	1.10	0.65	0.40	0.65	0.65
Maximum Total Area	NR	14%	16%	16%	16%
Maximum Total Nonsouth					
Facing Area	9.6%	NR	NR	NR	NR
Minimum South Facing Area	6.4%	NR	NR	NR	NR
SHADING COEFFICIENT⁴					
South Facing Glazing	NR	NR	0.66	0.66	0.66
West Facing Glazing	NR	NR	0.66	0.66	0.66
East Facing Glazing	NR	NR	0.66	0.66	0.66
North Facing Glazing	NR	NR	0.66	0.66	0.66
THERMAL MASS⁵	REQ	NR	REQ	20%	5%
INFILTRATION CONTROL					
Continuous Barrier	NR	NR	NR	NR	NR
Air-to-Air Heat Exchanger	NR	NR	NR	NR	NR
SPACE HEATING SYSTEM⁶					
Electric Resistant Allowed	NO	NO	YES ⁷	NO	NO
If Gas, AFUE =	78%	78%	78%	78%	78%
If Heat Pump,					
Split System HSPF ⁸ =	6.8	6.8	6.8	6.8	6.8
Single Package System HSPF =	6.6	6.6	6.6	6.6	6.6
SPACE COOLING SYSTEMS					
If Split System A/C, SEER =	10.0	10.0	10.0	10.0	10.0
If Single Package A/C, SEER ⁹ =	9.7	9.7	9.7	9.7	9.7
DOMESTIC WATER HEATING TYPE					
System must meet budget, see 151(b)1 and 151(f)(8)	ANY	ANY	ANY ¹⁰	ANY	ANY

LEGEND: NR = Not Required; NA = Not Applicable; REQ = Required

SEE NOTES FOLLOWING TABLE NO. 1-Z16

**TABLE NO. 1-Z3
ALTERNATIVE COMPONENT PACKAGES
FOR CLIMATE ZONE 3**

Component	PACKAGE				
	A	B	C ¹¹	D	E
BUILDING ENVELOPE					
Insulation Minimums ¹					
Ceiling	R30	R30	R38	R30	R30
Wood Frame Walls	R13	R19	R25	R13	R13
"Heavy Mass" Walls	(R4.5)	(R3.5)	NA	(R2.44)	(R2.44)
"Light Mass" Walls	[R5.0]	[R5.0]	NA	NA	NA
Slab Floor Perimeter	R7	R7	R7	NR	NR ²
Raised Floor	R13	R19	R30	R19 ³	R19
GLAZING					
Maximum U-value ¹²	1.10	0.65	0.40	0.75	0.75
Maximum Total Area	NR	16%	14%	20%	20%
Maximum Total Nonsouth Facing Area	9.6%	NR	NR	NR	NR
Minimum South Facing Area	6.4%	NR	NR	NR	NR
SHADING COEFFICIENT⁴					
South Facing Glazing	NR	NR	0.66	0.66	0.66
West Facing Glazing	NR	NR	0.66	0.66	0.66
East Facing Glazing	NR	NR	0.66	0.66	0.66
North Facing Glazing	NR	NR	0.66	0.66	0.66
THERMAL MASS⁵					
THERMAL MASS ⁵	REQ	NR	REQ	20%	5%
INFILTRATION CONTROL					
Continuous Barrier	NR	NR	NR	NR	NR
Air-to-Air Heat Exchanger	NR	NR	NR	NR	NR
SPACE HEATING SYSTEM⁶					
Electric Resistant Allowed	NO	NO	YES ⁷	NO	NO
If Gas, AFUE =	78%	78%	78%	78%	78%
If Heat Pump,					
Split System HSPF ⁸ =	6.8	6.8	6.8	6.8	6.8
Single Package System HSPF =	6.6	6.6	6.6	6.6	6.6
SPACE COOLING SYSTEMS					
If Split System A/C, SEER =	10.0	10.0	10.0	10.0	10.0
If Single Package A/C, SEER ⁹ =	9.7	9.7	9.7	9.7	9.7
DOMESTIC WATER HEATING TYPE					
System must meet budget, see 151(b)1 and 151(f)(8)	ANY	ANY	ANY ¹⁰	ANY	ANY

LEGEND: NR = Not Required; NA = Not Applicable; REQ = Required

SEE NOTES FOLLOWING TABLE NO. 1-Z16

TABLE NO. 1-Z4 ACPS

**TABLE NO. 1-Z4
ALTERNATIVE COMPONENT PACKAGES
FOR CLIMATE ZONE 4**

Component	PACKAGE				
	A	B	C ¹¹	D	E
BUILDING ENVELOPE					
Insulation Minimums ¹					
Ceiling	R30	R30	R38	R30	R30
Wood Frame Walls	R13	R19	R25	R13	R13
"Heavy Mass" Walls	(R3.5)	(R3.5)	NA	(R2.44)	(R2.44)
"Light Mass" Walls	[R5.0]	[R5.0]	NA	NA	NA
Slab Floor Perimeter	R7	R7	R7	NR	NR ²
Raised Floor	R13	R19	R30	R19 ³	R19
GLAZING					
Maximum U-value ¹²	1.10	0.65	0.40	0.75	0.75
Maximum Total Area	NR	16%	14%	20%	20%
Maximum Total Nonsouth					
Facing Area	9.6%	NR	NR	NR	NR
Minimum South Facing Area	6.4%	NR	NR	NR	NR
SHADING COEFFICIENT⁴					
South Facing Glazing	NR	NR	0.66	0.66	0.66
West Facing Glazing	NR	NR	0.66	0.66	0.66
East Facing Glazing	NR	NR	0.66	0.66	0.66
North Facing Glazing	NR	NR	0.66	0.66	0.66
THERMAL MASS⁵					
	REQ	NR	REQ	20%	5%
INFILTRATION CONTROL					
Continuous Barrier	NR	NR	NR	NR	NR
Air-to-Air Heat Exchanger	NR	NR	NR	NR	NR
SPACE HEATING SYSTEM⁶					
Electric Resistant Allowed	NO	NO	YES ⁷	NO	NO
If Gas, AFUE =	78%	78%	78%	78%	78%
If Heat Pump,					
Split System HSPF ⁸ =	6.8	6.8	6.8	6.8	6.8
Single Package System HSPF =	6.6	6.6	6.6	6.6	6.6
SPACE COOLING SYSTEMS					
If Split System A/C, SEER =	10.0	10.0	10.0	10.0	10.0
If Single Package A/C, SEER ⁹ =	9.7	9.7	9.7	9.7	9.7
DOMESTIC WATER HEATING TYPE					
System must meet budget, see 151(b)1 and 151(f)(8)	ANY	ANY	ANY ¹⁰	ANY	ANY

LEGEND: NR = Not Required; NA = Not Applicable; REQ = Required

SEE NOTES FOLLOWING TABLE NO. 1-Z16

**TABLE NO. 1-Z5
ALTERNATIVE COMPONENT PACKAGES
FOR CLIMATE ZONE 5**

Component	PACKAGE				
	A	B	C ¹¹	D	E
BUILDING ENVELOPE					
Insulation Minimums ¹					
Ceiling	R30	R30	R38	R30	R30
Wood Frame Walls	R13	R19	R25	R13	R13
"Heavy Mass" Walls	(R2.4)	(R2.3)	NA	(R2.44)	(R2.44)
"Light Mass" Walls	[R4.5]	[R4.5]	NA	NA	NA
Slab Floor Perimeter	R7	R7	R7	NR	NR ²
Raised Floor	R13	R19	R30	R19 ³	R19
GLAZING					
Maximum U-value ¹²	1.10	0.65	0.40	0.75	0.75
Maximum Total Area	NR	14 %	16 %	16 %	16 %
Maximum Total Nonsouth Facing Area	9.6 %	NR	NR	NR	NR
Minimum South Facing Area	6.4 %	NR	NR	NR	NR
SHADING COEFFICIENT⁴					
South Facing Glazing	NR	NR	0.66	0.66	0.66
West Facing Glazing	NR	NR	0.66	0.66	0.66
East Facing Glazing	NR	NR	0.66	0.66	0.66
North Facing Glazing	NR	NR	0.66	0.66	0.66
THERMAL MASS⁵					
	REQ	NR	REQ	20 %	5 %
INFILTRATION CONTROL					
Continuous Barrier	NR	NR	NR	NR	NR
Air-to-Air Heat Exchanger	NR	NR	NR	NR	NR
SPACE HEATING SYSTEM⁶					
Electric Resistant Allowed	NO	NO	YES ⁷	NO	NO
If Gas, AFUE =	78 %	78 %	78 %	78 %	78 %
If Heat Pump,					
Split System HSPF ⁸ =	6.8	6.8	6.8	6.8	6.8
Single Package System HSPF =	6.6	6.6	6.6	6.6	6.6
SPACE COOLING SYSTEMS					
If Split System A/C, SEER =	10.0	10.0	10.0	10.0	10.0
If Single Package A/C, SEER ⁹ =	9.7	9.7	9.7	9.7	9.7
DOMESTIC WATER HEATING TYPE					
System must meet budget, see 151(b)1 and 151(f)(8)	ANY	ANY	ANY ¹⁰	ANY	ANY

LEGEND: NR = Not Required; NA = Not Applicable; REQ = Required

SEE NOTES FOLLOWING TABLE NO. 1-Z16

TABLE NO. 1-Z6 ACPS

TABLE NO. 1-Z6
ALTERNATIVE COMPONENT PACKAGES
FOR CLIMATE ZONE 6

Component	PACKAGE				
	A	B	C ¹¹	D	E
BUILDING ENVELOPE					
<i>Insulation Minimums¹</i>					
Ceiling	R19	R30	R38	R30	R30
Wood Frame Walls	R13	R19	R21	R13	R13
"Heavy Mass" Walls	(R1.5)	(R1.6)	NA	(R2.44)	(R2.44)
"Light Mass" Walls	[R4.0]	[R4.5]	NA	NA	NA
Slab Floor Perimeter	NR	R7	R7	NR	NR ²
Raised Floor	R13	R19	R21	R19 ³	R19
GLAZING					
Maximum U-value ¹²	1.10	0.65	0.50	0.75	0.75
Maximum Total Area	NR	16%	14%	20%	20%
Maximum Total Nonsouth Facing Area	9.6%	NR	NR	NR	NR
Minimum South Facing Area	6.4%	NR	NR	NR	NR
SHADING COEFFICIENT⁴					
South Facing Glazing	NR	NR	0.66	0.66	0.66
West Facing Glazing	NR	NR	0.66	0.66	0.66
East Facing Glazing	NR	NR	0.66	0.66	0.66
North Facing Glazing	NR	NR	0.66	0.66	0.66
THERMAL MASS⁵					
	REQ	NR	REQ	20%	5%
INFILTRATION CONTROL					
Continuous Barrier	NR	NR	NR	NR	NR
Air-to-Air Heat Exchanger	NR	NR	NR	NR	NR
SPACE HEATING SYSTEM⁶					
Electric Resistant Allowed	NO	NO	YES ⁷	NO	NO
If Gas, AFUE =	78%	78%	78%	78%	78%
If Heat Pump,					
Split System HSPF ⁸ =	6.8	6.8	6.8	6.8	6.8
Single Package System HSPF =	6.6	6.6	6.6	6.6	6.6
SPACE COOLING SYSTEMS					
If Split System A/C, SEER =	10.0	10.0	10.0	10.0	10.0
If Single Package A/C, SEER ⁹ =	9.7	9.7	9.7	9.7	9.7
DOMESTIC WATER HEATING TYPE					
System must meet budget, see 151(b)1 and 151(f)(8)	ANY	ANY	ANY ¹⁰	ANY	ANY

LEGEND: NR = Not Required; NA = Not Applicable; REQ = Required

SEE NOTES FOLLOWING TABLE NO. 1-Z16

**TABLE NO. 1-Z7
ALTERNATIVE COMPONENT PACKAGES
FOR CLIMATE ZONE 7**

Component	PACKAGE				
	A	B	C ¹¹	D	E
BUILDING ENVELOPE					
Insulation Minimums ¹					
Ceiling	R19	R30	R38	R30	R30
Wood Frame Walls	R13	R13	R21	R13	R13
"Heavy Mass" Walls	(R1.7)	(R1.4)	NA	(R2.44)	(R2.44)
"Light Mass" Walls	[R4.0]	[R3.5]	NA	NA	NA
Slab Floor Perimeter	NR	R7	R7	NR	NR ²
Raised Floor	R13	R13	R21	R19 ³	R19
GLAZING					
Maximum U-value ¹²	1.10	0.65	0.50	0.75	0.75
Maximum Total Area	NR	14%	14%	20%	20%
Maximum Total Nonsouth Facing Area	9.6%	NR	NR	NR	NR
Minimum South Facing Area	6.4%	NR	NR	NR	NR
SHADING COEFFICIENT⁴					
South Facing Glazing	NR	NR	0.66	0.66	0.66
West Facing Glazing	NR	NR	0.66	0.66	0.66
East Facing Glazing	NR	NR	0.66	0.66	0.66
North Facing Glazing	NR	NR	0.66	0.66	0.66
THERMAL MASS⁵					
REQ	REQ	NR	REQ	20%	5%
INFILTRATION CONTROL					
Continuous Barrier	NR	NR	NR	NR	NR
Air-to-Air Heat Exchanger	NR	NR	NR	NR	NR
SPACE HEATING SYSTEM⁶					
Electric Resistant Allowed	NO	NO	YES ⁷	NO	NO
If Gas, AFUE =	78%	78%	78%	78%	78%
If Heat Pump,					
Split System HSPF ⁸ =	6.8	6.8	6.8	6.8	6.8
Single Package System HSPF =	6.6	6.6	6.6	6.6	6.6
SPACE COOLING SYSTEMS					
If Split System A/C, SEER =	10.0	10.0	10.0	10.0	10.0
If Single Package A/C, SEER ⁹ =	9.7	9.7	9.7	9.7	9.7
DOMESTIC WATER HEATING TYPE					
System must meet budget, see 151(b)1 and 151(f)(8)	ANY	ANY	ANY ¹⁰	ANY	ANY

LEGEND: NR = Not Required; NA = Not Applicable; REQ = Required

SEE NOTES FOLLOWING TABLE NO. 1-Z16

TABLE NO. 1-Z8 ACPS

**TABLE NO. 1-Z8
ALTERNATIVE COMPONENT PACKAGES
FOR CLIMATE ZONE 8**

Component	PACKAGE				
	A	B	C ¹¹	D	E
BUILDING ENVELOPE					
Insulation Minimums ¹					
Ceiling	R30	R30	R38	R30	R30
Wood Frame Walls	R13	R19	R21	R13	R13
"Heavy Mass" Walls	(R1.6)	(R1.6)	NA	(R2.44)	(R2.44)
"Light Mass" Walls	[R4.0]	[R4.5]	NA	NA	NA
Slab Floor Perimeter	NR	R7	R7	NR	NR ²
Raised Floor	R13	R19	R21	R19 ³	R19
GLAZING					
Maximum U-value ¹²	1.10	0.65	0.50	0.75	0.75
Maximum Total Area	NR	14%	14%	20%	20%
Maximum Total Nonsouth Facing Area	9.6%	NR	NR	NR	NR
Minimum South Facing Area	6.4%	NR	NR	NR	NR
SHADING COEFFICIENT⁴					
South Facing Glazing	0.40	0.40	0.66	0.66	0.66
West Facing Glazing	0.40	0.40	0.40	0.40	0.40
East Facing Glazing	NR	NR	0.40	0.40	0.40
North Facing Glazing	NR	NR	0.66	0.66	0.66
THERMAL MASS⁵					
	REQ	NR	REQ	20%	5%
INFILTRATION CONTROL					
Continuous Barrier	NR	NR	NR	NR	NR
Air-to-Air Heat Exchanger	NR	NR	NR	NR	NR
SPACE HEATING SYSTEM⁶					
Electric Resistant Allowed	NO	NO	YES ⁷	NO	NO
If Gas, AFUE =	78%	78%	78%	78%	78%
If Heat Pump,					
Split System HSPF ⁸ =	6.8	6.8	6.8	6.8	6.8
Single Package System HSPF =	6.6	6.6	6.6	6.6	6.6
SPACE COOLING SYSTEMS					
If Split System A/C, SEER =	10.0	10.0	10.0	10.0	10.0
If Single Package A/C, SEER ⁹ =	9.7	9.7	9.7	9.7	9.7
DOMESTIC WATER HEATING TYPE					
System must meet budget, see 151(b)1 and 151(f)(8)	ANY	ANY	ANY ¹⁰	ANY	ANY

LEGEND: NR = Not Required; NA = Not Applicable; REQ = Required

SEE NOTES FOLLOWING TABLE NO. 1-Z16

**TABLE NO. 1-Z9
ALTERNATIVE COMPONENT PACKAGES
FOR CLIMATE ZONE 9**

Component	PACKAGE				
	A	B	C ¹¹	D	E
BUILDING ENVELOPE					
Insulation Minimums ¹					
Ceiling	R30	R30	R38	R30	R30
Wood Frame Walls	R13	R19	R21	R13	R13
"Heavy Mass" Walls	(R1.4)	(R1.5)	NA	(R2.44)	(R2.44)
"Light Mass" Walls	[R4.0]	[R4.0]	NA	NA	NA
Slab Floor Perimeter	R7	R7	R7	NR	NR ²
Raised Floor	R13	R19	R21	R19 ³	R19
GLAZING					
Maximum U-value ¹²	1.10	0.65	0.50	0.75	0.75
Maximum Total Area	NR	14%	14%	20%	20%
Maximum Total Nonsouth Facing Area	9.6%	NR	NR	NR	NR
Minimum South Facing Area	6.4%	NR	NR	NR	NR
SHADING COEFFICIENT⁴					
South Facing Glazing	0.40	0.40	0.66	0.66	0.66
West Facing Glazing	0.40	0.40	0.40	0.40	0.40
East Facing Glazing	NR	NR	0.40	0.40	0.40
North Facing Glazing	NR	NR	0.66	0.66	0.66
THERMAL MASS⁵					
	REQ	NR	REQ	20%	5%
INFILTRATION CONTROL					
Continuous Barrier	NR	NR	NR	NR	NR
Air-to-Air Heat Exchanger	NR	NR	NR	NR	NR
SPACE HEATING SYSTEM⁶					
Electric Resistant Allowed	NO	NO	YES ⁷	NO	NO
If Gas, AFUE =	78%	78%	78%	78%	78%
If Heat Pump,					
Split System HSPF ⁸ =	6.8	6.8	6.8	6.8	6.8
Single Package System HSPF =	6.6	6.6	6.6	6.6	6.6
SPACE COOLING SYSTEMS					
If Split System A/C, SEER =	10.0	10.0	10.0	10.0	10.0
If Single Package A/C, SEER ⁹ =	9.7	9.7	9.7	9.7	9.7
DOMESTIC WATER HEATING TYPE					
System must meet budget, see 151(b)1 and 151(f)(8)	ANY	ANY	ANY ¹⁰	ANY	ANY

LEGEND: NR = Not Required; NA = Not Applicable; REQ = Required

SEE NOTES FOLLOWING TABLE NO. 1-Z16

TABLE NO. 1-Z10 ACPS

**TABLE NO. 1-Z10
ALTERNATIVE COMPONENT PACKAGES
FOR CLIMATE ZONE 10**

Component	PACKAGE				
	A	B	C ¹¹	D	E
BUILDING ENVELOPE					
Insulation Minimums ¹					
Ceiling	R30	R30	R49	R30	R30
Wood Frame Walls	R13	R19	R25	R13	R13
"Heavy Mass" Walls	(R1.9)	(R2.0)	NA	(R2.44)	(R2.44)
"Light Mass" Walls	[R4.5]	[R4.5]	NA	NA	NA
Slab Floor Perimeter	R7	R7	R7	NR	NR ²
Raised Floor	R13	R19	R30	R19 ³	R19
GLAZING					
Maximum U-value ¹²	1.10	0.65	0.40	0.75	0.75
Maximum Total Area	NR	16%	16%	20%	20%
Maximum Total Nonsouth Facing Area	9.6%	NR	NR	NR	NR
Minimum South Facing Area	6.4%	NR	NR	NR	NR
SHADING COEFFICIENT⁴					
South Facing Glazing	0.40	0.40	0.66	0.66	0.66
West Facing Glazing	0.40	0.40	0.40	0.40	0.40
East Facing Glazing	NR	NR	0.40	0.40	0.40
North Facing Glazing	NR	NR	0.66	0.66	0.66
THERMAL MASS⁵					
	REQ	NR	REQ	20%	5%
INFILTRATION CONTROL					
Continuous Barrier	NR	NR	NR	NR	NR
Air-to-Air Heat Exchanger	NR	NR	NR	NR	NR
SPACE HEATING SYSTEM⁶					
Electric Resistant Allowed	NO	NO	YES ⁷	NO	NO
If Gas, AFUE =	78%	78%	78%	78%	78%
If Heat Pump,					
Split System HSPF ⁸ =	6.8	6.8	6.8	6.8	6.8
Single Package System HSPF =	6.6	6.6	6.6	6.6	6.6
SPACE COOLING SYSTEMS					
If Split System A/C, SEER =	10.0	10.0	10.0	10.0	10.0
If Single Package A/C, SEER ⁹ =	9.7	9.7	9.7	9.7	9.7
DOMESTIC WATER HEATING TYPE					
System must meet budget, see 151(b)1 and 151(f)(8)	ANY	ANY	ANY ¹⁰	ANY	ANY

LEGEND: NR = Not Required; NA = Not Applicable; REQ = Required

SEE NOTES FOLLOWING TABLE NO. 1-Z16

TABLE NO. 1-Z11
ALTERNATIVE COMPONENT PACKAGES
FOR CLIMATE ZONE 11

Component	PACKAGE				
	A	B	C ¹¹	D	E
BUILDING ENVELOPE					
Insulation Minimums ¹					
Ceiling	R30	R30	R49	R38	R38
Wood Frame Walls	R13	R19	R29	R19	R19
"Heavy Mass" Walls	(R5.0)	(R5.5)	NA	(R4.76)	(R4.76)
"Light Mass" Walls	[R6.0]	[R6.5]	NA	NA	NA
Slab Floor Perimeter	R7	R7	R7	NR	NR ²
Raised Floor	R13	R19	R30	R19 ³	R19
GLAZING					
Maximum U-value ¹²	0.65	0.65	0.40	0.65	0.65
Maximum Total Area	NR	14%	16%	16%	16%
Maximum Total Nonsouth Facing Area	9.6%	NR	NR	NR	NR
Minimum South Facing Area	6.4%	NR	NR	NR	NR
SHADING COEFFICIENT⁴					
South Facing Glazing	0.40	0.40	0.66	0.66	0.66
West Facing Glazing	0.40	0.40	0.40	0.40	0.40
East Facing Glazing	NR	NR	0.40	0.40	0.40
North Facing Glazing	NR	NR	0.66	0.66	0.66
THERMAL MASS⁵					
	REQ	NR	REQ	20%	5%
INFILTRATION CONTROL					
Continuous Barrier	NR	NR	NR	NR	NR
Air-to-Air Heat Exchanger	NR	NR	NR	NR	NR
SPACE HEATING SYSTEM⁶					
Electric Resistant Allowed	NO	NO	YES ⁷	NO	NO
If Gas, AFUE =	78%	78%	78%	78%	78%
If Heat Pump,					
Split System HSPF ⁸ =	6.8	6.8	6.8	6.8	6.8
Single Package System HSPF =	6.6	6.6	6.6	6.6	6.6
SPACE COOLING SYSTEMS					
If Split System A/C, SEER =	10.0	10.0	10.0	10.0	10.0
If Single Package A/C, SEER ⁹ =	9.7	9.7	9.7	9.7	9.7
DOMESTIC WATER HEATING TYPE					
System must meet budget, see 151(b)1 and 151(f)(8)	ANY	ANY	ANY ¹⁰	ANY	ANY

LEGEND: NR = Not Required; NA = Not Applicable; REQ = Required

SEE NOTES FOLLOWING TABLE NO. 1-Z16

TABLE NO. 1-Z12 ACPS

TABLE NO. 1-Z12
ALTERNATIVE COMPONENT PACKAGES
FOR CLIMATE ZONE 12

Component	PACKAGE				
	A	B	C ¹¹	D	E
BUILDING ENVELOPE					
Insulation Minimums ¹					
Ceiling	R30	R30	R49	R38	R38
Wood Frame Walls	R13	R19	R29	R19	R19
"Heavy Mass" Walls	(R3.5)	(R3.5)	NA	(R4.76)	(R4.76)
"Light Mass" Walls	[R5.0]	[R5.5]	NA	NA	NA
Slab Floor Perimeter	NR	R7	R7	NR	NR ²
Raised Floor	R13	R19	R30	R19 ³	R19
GLAZING					
Maximum U-value ¹²	0.65	0.65	0.40	0.65	0.65
Maximum Total Area	NR	14%	16%	16%	16%
Maximum Total Nonsouth Facing Area	9.6%	NR	NR	NR	NR
Minimum South Facing Area	6.4%	NR	NR	NR	NR
SHADING COEFFICIENT⁴					
South Facing Glazing	0.40	0.40	0.66	0.66	0.66
West Facing Glazing	0.40	0.40	0.40	0.40	0.40
East Facing Glazing	NR	NR	0.40	0.40	0.40
North Facing Glazing	NR	NR	0.66	0.66	0.66
THERMAL MASS⁵					
	REQ	NR	REQ	20%	5%
INFILTRATION CONTROL					
Continuous Barrier	NR	NR	NR	NR	NR
Air-to-Air Heat Exchanger	NR	NR	NR	NR	NR
SPACE HEATING SYSTEM⁶					
Electric Resistant Allowed	NO	NO	YES ⁷	NO	NO
If Gas, AFUE =	78%	78%	78%	78%	78%
If Heat Pump,					
Split System HSPF ⁸ =	6.8	6.8	6.8	6.8	6.8
Single Package System HSPF =	6.6	6.6	6.6	6.6	6.6
SPACE COOLING SYSTEMS					
If Split System A/C, SEER =	10.0	10.0	10.0	10.0	10.0
If Single Package A/C, SEER ⁹ =	9.7	9.7	9.7	9.7	9.7
DOMESTIC WATER HEATING TYPE					
System must meet budget, see 151(b)1 and 151(f)(8)	ANY	ANY	ANY ¹⁰	ANY	ANY

LEGEND: NR = Not Required; NA = Not Applicable; REQ = Required

SEE NOTES FOLLOWING TABLE NO. 1-Z16

**TABLE NO. 1-Z13
ALTERNATIVE COMPONENT PACKAGES
FOR CLIMATE ZONE 13**

Component	PACKAGE				
	A	B	C ¹¹	D	E
BUILDING ENVELOPE					
Insulation Minimums ¹					
Ceiling	R30	R30	R49	R38	R38
Wood Frame Walls	R13	R19	R29	R19	R19
"Heavy Mass" Walls	(R4.0)	(R4.0)	NA	(R4.76)	(R4.76)
"Light Mass" Walls	[R5.5]	[R6.0]	NA	NA	NA
Slab Floor Perimeter	NR	R7	R7	NR	NR ²
Raised Floor	R13	R19	R30	R19 ³	R19
GLAZING					
Maximum U-value ¹²	0.65	0.65	0.40	0.65	0.65
Maximum Total Area	NR	14%	16%	16%	16%
Maximum Total Nonsouth					
Facing Area	9.6%	NR	NR	NR	NR
Minimum South Facing Area	6.4%	NR	NR	NR	NR
SHADING COEFFICIENT⁴					
South Facing Glazing	0.40	0.40	0.66	0.66	0.66
West Facing Glazing	0.40	0.40	0.40	0.40	0.40
East Facing Glazing	NR	NR	0.40	0.40	0.40
North Facing Glazing	NR	NR	0.66	0.66	0.66
THERMAL MASS⁵					
	REQ	NR	REQ	20%	5%
INFILTRATION CONTROL					
Continuous Barrier	NR	NR	NR	NR	NR
Air-to-Air Heat Exchanger	NR	NR	NR	NR	NR
SPACE HEATING SYSTEM⁶					
Electric Resistant Allowed	NO	NO	YES ⁷	NO	NO
If Gas, AFUE =	78%	78%	78%	78%	78%
If Heat Pump,					
Split System HSPF ⁸ =	6.8	6.8	6.8	6.8	6.8
Single Package System HSPF =	6.6	6.6	6.6	6.6	6.6
SPACE COOLING SYSTEMS					
If Split System A/C, SEER =	10.0	10.0	10.0	10.0	10.0
If Single Package A/C, SEER ⁹ =	9.7	9.7	9.7	9.7	9.7
DOMESTIC WATER HEATING TYPE					
System must meet budget, see 151(b)1 and 151(f)(8)	ANY	ANY	ANY ¹⁰	ANY	ANY

LEGEND: NR = Not Required; NA = Not Applicable; REQ = Required

SEE NOTES FOLLOWING TABLE NO. 1-Z16

TABLE NO. 1-Z14 ACPS

TABLE NO. 1-Z14
ALTERNATIVE COMPONENT PACKAGES
FOR CLIMATE ZONE 14

Component	PACKAGE				
	A	B	C ¹¹	D	E
BUILDING ENVELOPE					
Insulation Minimums ¹					
Ceiling	R38	R38	R49	R38	R38
Wood Frame Walls	R19	R19	R29	R21	R21
"Heavy Mass" Walls	(R7.0)	(R5.5)	NA	(R4.76)	(R4.76)
"Light Mass" Walls	[R8.0]	[R6.5]	NA	NA	NA
Slab Floor Perimeter	R7	R7	R7	NR	NR ²
Raised Floor	R19	R19	R30	R19 ³	R19
GLAZING					
Maximum U-value ¹²	0.65	0.65	0.40	0.65	0.65
Maximum Total Area	NR	16%	14%	16%	16%
Maximum Total Nonsouth Facing Area	9.6%	NR	NR	NR	NR
Minimum South Facing Area	6.4%	NR	NR	NR	NR
SHADING COEFFICIENT⁴					
South Facing Glazing	0.15	0.15	0.66	0.66	0.66
West Facing Glazing	0.15	0.15	0.40	0.40	0.40
East Facing Glazing	NR	NR	0.40	0.40	0.40
North Facing Glazing	NR	NR	0.66	0.66	0.66
THERMAL MASS⁵					
	REQ	NR	REQ	20%	5%
INFILTRATION CONTROL					
Continuous Barrier	NR	REQ	NR	NR	NR
Air-to-Air Heat Exchanger	NR	REQ	NR	NR	NR
SPACE HEATING SYSTEM⁶					
Electric Resistant Allowed	NO	NO	YES ⁷	NO	NO
If Gas, AFUE =	78%	78%	78%	78%	78%
If Heat Pump,					
Split System HSPF ⁸ =	6.8	6.8	6.8	6.8	6.8
Single Package System HSPF =	6.6	6.6	6.6	6.6	6.6
SPACE COOLING SYSTEMS					
If Split System A/C, SEER =	10.0	10.0	10.0	10.0	10.0
If Single Package A/C, SEER ⁹ =	9.7	9.7	9.7	9.7	9.7
DOMESTIC WATER HEATING TYPE					
System must meet budget, see 151(b)1 and 151(f)(8)	ANY	ANY	ANY ¹⁰	ANY	ANY

LEGEND: NR = Not Required; NA = Not Applicable; REQ = Required

SEE NOTES FOLLOWING TABLE NO. 1-Z16

**TABLE NO. 1-Z15
ALTERNATIVE COMPONENT PACKAGES
FOR CLIMATE ZONE 15**

Component	PACKAGE				
	A	B	C ¹¹	D	E
BUILDING ENVELOPE					
Insulation Minimums ¹					
Ceiling	R30	R38	R49	R38	R38
Wood Frame Walls	R19	R19	R29	R21	R21
"Heavy Mass" Walls	(R5.5)	(R4.5)	NA	(R4.76)	(R4.76)
"Light Mass" Walls	[R7.0]	[R6.0]	NA	NA	NA
Slab Floor Perimeter	R7	R7	R7	NR	NR ²
Raised Floor	R19	R19	R21	R19 ³	R19
GLAZING					
Maximum U-value ¹²	0.65	0.65	0.40	0.65	0.65
Maximum Total Area	NR	16%	16%	16%	16%
Maximum Total Nonsouth Facing Area	9.6%	NR	NR	NR	NR
Minimum South Facing Area	6.4%	NR	NR	NR	NR
SHADING COEFFICIENT⁴					
South Facing Glazing	0.15	0.15	0.40	0.40	0.40
West Facing Glazing	0.15	0.15	0.40	0.40	0.40
East Facing Glazing	NR	NR	0.40	0.40	0.40
North Facing Glazing	NR	NR	0.66	0.66	0.66
THERMAL MASS⁵					
	REQ	NR	REQ	20%	5%
INFILTRATION CONTROL					
Continuous Barrier	NR	REQ	NR	NR	NR
Air-to-Air Heat Exchanger	NR	REQ	NR	NR	NR
SPACE HEATING SYSTEM⁶					
Electric Resistant Allowed	NO	NO	YES ⁷	NO	NO
If Gas, AFUE =	78%	78%	78%	78%	78%
If Heat Pump,					
Split System HSPF ⁸ =	6.8	6.8	6.8	6.8	6.8
Single Package System HSPF =	6.6	6.6	6.6	6.6	6.6
SPACE COOLING SYSTEMS					
If Split System A/C, SEER =	10.0	10.0	10.0	10.0	10.0
If Single Package A/C, SEER ⁹ =	9.7	9.7	9.7	9.7	9.7
DOMESTIC WATER HEATING TYPE					
System must meet budget, see 151(b)1 and 151(f)(8)	ANY	ANY	ANY ¹⁰	ANY	ANY

LEGEND: NR = Not Required; NA = Not Applicable; REQ = Required

SEE NOTES FOLLOWING TABLE NO. 1-Z16

TABLE NO. 1-Z16 ACPS

**TABLE NO. 1-Z16
ALTERNATIVE COMPONENT PACKAGES
FOR CLIMATE ZONE 16**

Component	PACKAGE				
	A	B	C ¹¹	D	E
BUILDING ENVELOPE					
Insulation Minimums ¹					
Ceiling	R38	R38	R49	R38	R38
Wood Frame Walls	R19	R19	R29	R21	R21
"Heavy Mass" Walls	(R9.5)	(R7.0)	NA	(R4.76)	(R4.76)
"Light Mass" Walls	[R9.5]	[R7.5]	NA	NA	NA
Slab Floor Perimeter	R7	R7	R7	R7	R7 ²
Raised Floor	R19	R19	R30	R19 ³	R19
GLAZING					
Maximum U-value ¹²	0.65	0.65	0.40	0.60	0.60
Maximum Total Area	NR	16%	14%	16%	16%
Maximum Total Nonsouth Facing Area	9.6%	NR	NR	NR	NR
Minimum South Facing Area	6.4%	NR	NR	NR	NR
SHADING COEFFICIENT⁴					
South Facing Glazing	NR	NR	0.66	0.66	0.66
West Facing Glazing	NR	NR	0.66	0.66	0.66
East Facing Glazing	NR	NR	0.66	0.66	0.66
North Facing Glazing	NR	NR	0.66	0.66	0.66
THERMAL MASS⁵					
	REQ	NR	REQ	20%	5%
INFILTRATION CONTROL					
Continuous Barrier	NR	REQ	NR	NR	NR
Air-to-Air Heat Exchanger	NR	REQ	NR	NR	NR
SPACE HEATING SYSTEM⁶					
Electric Resistant Allowed	NO	NO	YES ⁷	NO	NO
If Gas, AFUE =	78%	78%	78%	78%	78%
If Heat Pump,					
Split System HSPF ⁸ =	6.8	6.8	6.8	6.8	6.8
Single Package System HSPF =	6.6	6.6	6.6	6.6	6.6
SPACE COOLING SYSTEMS					
If Split System A/C, SEER =	10.0	10.0	10.0	10.0	10.0
If Single Package A/C, SEER ⁹ =	9.7	9.7	9.7	9.7	9.7
DOMESTIC WATER HEATING TYPE					
System must meet budget, see 151(b)1 and 151(f)(8)	ANY	ANY	ANY ¹⁰	ANY	ANY

LEGEND: NR = Not Required; NA = Not Applicable; REQ = Required

SEE NOTES FOLLOWING TABLE NO. 1-Z16

**NOTES TO THE LOW-RISE RESIDENTIAL PACKAGES
IN TABLES NO. 1-Z1 THROUGH 1-Z16**

1. The R-values shown for ceiling, wood frame wall and raised floor are for wood frame construction with insulation installed between the framing members. For alternative construction assemblies, see Section 151(f)1.A.

The heavy mass wall R-value in parentheses is the minimum R-value for the entire wall assembly if the wall weight exceeds 40 pounds per square foot. The light mass wall R-value in brackets is the minimum R-value for the entire assembly if the heat capacity of the wall meets or exceeds the result of multiplying the bracketed minimum R-value by 0.65. Any insulation installed on heavy or light mass walls 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 thermal mass requirement.

2. If Package E requires slab insulation (Zone 16), the insulation must be installed along any slab portions of the raised floor building, except for portions to which the exceptions in Section 151(f)1.B. apply.
3. Package D requires raised floor insulation to be installed under any raised floor portion of the slab floor building.
4. A combined shading coefficient (SC) of 0.66 corresponds to clear dual glazing fenestration products with standard exterior and interior shading devices, such as insect screens and light drapes. If the package specifies a shading coefficient of 0.66, the building official shall assume that standard exterior and interior shading will be installed by the builder or occupant. If the package specifies a shading coefficient of 0.40 or lower, the builder shall meet the requirements of Section 151(f)3.
5. If the package requires thermal mass, meet the requirements of Section 151(f)4. When using the performance approach, the mass requirement for Package D is based on having 20 percent of the ground floor slab area exposed to conditioned space with no thermal resistance material on the surface. The remaining 80 percent of the ground floor slab area has a surface R-value of 2.0. The slab is composed of concrete at least 3.5 inches thick with a volumetric heat capacity of 28, a conductivity of 0.98, and a surface conductance of 1.3.

The mass requirement for Package E is based on having mass equivalent in performance to 5 percent of the ground floor area of an exposed 2-inch thick concrete slab with a volumetric heat capacity of 28, a conductivity of 0.98, a surface conductance of 1.3 and no thermal resistance on the surface.

6. Automatic setback thermostats must be installed in conjunction with all space heating systems, in accordance with Section 151(f)9.
7. Ducts in Package C shall be insulated to an installed value of at least R-8.
8. HSPF means "heating seasonal performance factor."
9. If the air conditioner is a single package system, until January 1, 1993, the minimum SEER is 8.9.
10. Electric resistance water heating is allowed as the main heat source in Package C only if the water heater is located within the building envelope and a minimum of 25 percent of the energy for water heating is provided by a passive or active solar system or a wood stove boiler. The wood stove boiler credit is not allowed in climate zones 8, 10, and 15, nor in localities that do not allow wood stoves.
11. Package C is the only package that allows electric resistance space heating. Package C may be used only if the building is in an area (1) where natural gas is not currently available and (2) where extension of natural gas service is impractical, as determined by the natural gas utility.
12. For glazing U-value rating procedures and labeling requirements see Section 116(a)2.

[NOTE: Authority cited: Public Resources Code, Section 25218(e), 25402, 25402.1
Reference: Public Resources Code, Section 25402.]

**SUBCHAPTER 9 (SECTION 152):
LOW-RISE RESIDENTIAL BUILDINGS -- ADDITIONS AND ALTERATIONS IN
EXISTING LOW-RISE RESIDENTIAL BUILDINGS**

Section 152. Energy Efficiency Standards For Additions and Alterations In Existing Low-Rise Residential Buildings

- (a) Additions. Additions to existing residential buildings shall meet the requirements of Sections 111 through 118, Section 150, and either Section 152(a)1. or Section 152(a)2.

EXCEPTION No. 1 to Section 152(a): Existing structures with R-11 framed walls showing compliance with Section 152(a)2. (Performance Approach) are exempt from Section 150(c).

EXCEPTION No. 2 to Section 152(a): Any dual-glazed greenhouse window and dual-glazed skylight installed in an addition complies with Section 151(f)2.A.

EXCEPTION No. 3 to Section 152(a): If the addition will increase the total number of water heaters in the building, one of the following types of water heaters may be installed to comply with Section 152(a)1. or Section 152(a)2.A, and Section 152(c):

- (1) A gas storage non-recirculating water heating system that does not exceed 50 gallons capacity and has an R-12 or greater external insulation wrap; or
- (2) If no natural gas is connected to the building, an electric storage water heater that does not exceed 50 gallons capacity, has an energy factor not less than 0.90, and has an R-12 or greater external insulation wrap; or
- (3) A water heating system determined by the Executive Director to use no more energy than the one specified in (1) above; or if no natural gas is connected to the building, a water heating system determined by the Executive Director to use no more energy than the one specified in (2) above.

For prescriptive compliance with Section 152(a)1., the water heating systems requirement in Section 151(f)8. shall not apply. For performance compliance for the addition alone, only the space conditioning budgets of Section 151(b)2. shall be used; the water heating budgets of Section 151(b)1. shall not apply.

152(a)-2.

The performance approach for the existing building and the addition in Section 152(a)2.B may be used to show compliance, regardless of the type of water heater installed.

EXCEPTION No. 4 to Section 152(a): When heating and/or cooling will be extended to an addition from the existing system(s), the existing equipment need not comply with Title 24, Part 6. The heating system capacity must be adequate to meet the minimum requirements of UBC Section 310.11.

1. Prescriptive Approach. Additions to existing buildings shall meet the following additional requirements:

- A. Additions up to 100 square feet shall not exceed 50 square feet of glazing and the glazing U-value shall not exceed 0.75; or
- B. Additions less than 1000 square feet shall meet all the requirements of Package D or E [Section 151(f) and Tables No. 1-Z1 through 1-Z16], except that the addition's total glazing area limit is the maximum allowed in Package D plus the glazing area that was removed by the addition and the wall insulation value need not exceed R-13.

EXCEPTION to Section 152 (a) 1.B.: If an addition is less than 500 square feet, glazing may have a U-value not to exceed 0.75 in lieu of any lower U-value required by the Package.

- C. Additions of 1000 square feet or greater shall meet all the requirements of Package D or E [Section 151(f) and Tables No. 1-Z1 through 1-Z16].

2. Performance Approach. Performance calculations shall meet the requirements of Section 151(a)-(e), pursuant to either A or B, below.

- A. The addition complies if the addition alone meets the combined water heating and space conditioning energy budgets.
- B. The addition complies if the energy efficiency of the existing building is improved such that the source energy consumption of the improved existing building and the addition is equal to or less than that of the unimproved existing building plus an addition that complies with the applicable energy budget.

- (b) Alterations. Alterations to existing residential buildings shall meet any requirements of Sections 111 through 118 and Section 150 that apply to the system or envelope component being changed. The U-value of any fenestration product replaced or added as part of an alteration shall not exceed 0.75.

EXCEPTION to Section 152(b): Any dual-glazed greenhouse window and dual-glazed skylight installed as part of an alteration complies with the U-value requirements applicable to alterations.

Note: Fenestration products repaired or replaced, not as part of an alteration, need not comply with the U-value requirements applicable to alterations.

- (c) Electric resistance water heating or space conditioning systems may be installed in or in conjunction with an addition only if the electric resistance system meets the applicable energy budget(s) from Section 151(b) pursuant to Section 152(a)2.
- (d) Any addition or alteration may comply with the requirements of Title 24, Part 6 by meeting the requirements for new buildings for the building as a whole.

[NOTE: Authority cited: Public Resources Code, Section 25218(e), 25402, 25402.1
Reference: Public Resources Code, Section 25402.]

**CALIFORNIA MECHANICAL CODE
PART 4, TITLE 24
CALIFORNIA CODE OF REGULATIONS**

**CHAPTER 6
DUCTS**

Adoption Table No. 6

Code Section	CEC
Entire 1994 UMC noted in this table	
601	X ¹
603	X ¹
604	X ¹

NOTE No. 1. Adopted by reference for Occupancies A, B, E, F, M, R and S; see Sections 118, 124, 150 and 151.

APPENDIX 1-A
STANDARDS REFERENCED IN ENERGY EFFICIENCY REGULATIONS

STATE OF CALIFORNIA

Appliance Efficiency Regulations
Standards for Insulating Material
Nonresidential Manual
Residential Manual
Various Directories for Certified Appliances
Directory of Certified Insulating Materials

Available from: California Energy Commission
Publications Office
1516 Ninth Street, MS-13
Sacramento, CA 95814-5512
(916) 654-5200

INTERNATIONAL CONFERENCE OF BUILDING OFFICIALS

Uniform Building Code, 1994 Edition
Uniform Mechanical Code, 1994 Edition

Available from: International Conference of Building Officials
5360 South Workman Mill Road
Whittier, CA 90601
(213) 699-0541

AIR-CONDITIONING AND REFRIGERATION INSTITUTE

ARI 210/240-89 Standard for Unitary Air-Conditioning
Equipment and for Air-Source Heat Pump
Equipment
ARI 320-86 Standard for Water-Source Heat Pumps
ARI 340-86 Standard for Commercial and Industrial Unitary
Heat Pump Equipment
ARI 360-86 Standard for Commercial and Industrial Unitary
Air-Conditioning Equipment

APPENDIX 1-A

ARI 365-87	Standard for Commercial and Industrial Unitary Air-Conditioning Condensing Units.
ARI 520-90	Standard for Positive Displacement Refrigerant Compressors, Compressor Units, and Condensing Units
ARI 550-90	Standard for Centrifugal or Rotary Screw Water- Chilling Packages
ARI 560-82	Standard for Absorption Water-Chilling Packages
ARI 590-1986	Standard for Reciprocating Water-Chilling Packages

Available from: Air-Conditioning and Refrigeration Institute
1501 Wilson Blvd., Suite 600
Arlington, VA 22209
(703) 524-8800

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Handbook and Product Directory

Equipment Volume, 1988 Edition.

HVAC Systems and Applications Volume, Chapter 54, 1987 Edition.

Fundamentals Volume, 1989 Edition.

STANDARDS

ANSI/ASHRAE 55-1981	Thermal Environment Conditions for Human Occupancy
ASHRAE 62-89	Standards for Natural and Mechanical Ventilation and Ventilation for Acceptable Indoor Air Quality

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

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AIR-CONDITIONING ENGINEERS (REGIONAL PUBLICATIONS)

Recommended Outdoor Design Temperatures for Northern California, 1977

Available from: ASHRAE
Golden Gate Chapter
370 Brannan Street
San Francisco, CA 94102
(415) 495-4552

Climatic Data For Region X, Arizona, California, Hawaii, and Nevada,
Publication SPPCDX, 1982

Available from: ASHRAE - Climatic Data
Southern California Chapter
P.O. Box 6306
Alhambra, CA 91802

AMERICAN NATIONAL STANDARDS--Z21 SERIES

- ANSI Z21.10.3--1987 Standard for Gas Water Heaters, Volume III,
Storage, with input ratings above 75,000
BTU/HR, Circulating, Instantaneous Water
Heaters
- ANSI Z21.11.1--1988 Standard for Gas-Fired Room Heaters, Volume I,
Vented Room Heaters
- ANSI Z21.13-87 Standard for Gas-Fired Low Pressure Steam and
Hot Water Boilers
- ANSI Z21.40.1--1981 Standard for Gas-Fired Absorption Summer Air
Conditioning Appliance
- ANSI Z21.44--1988 Standard for Gas-Fired Gravity and Fan Type
Direct Vent Wall Furnaces
- ANSI Z21.47--1987 Standard for Gas-Fired Central Furnace
- ANSI Z21.48--1989 Standard for Gas-Fired Gravity and Fan type
Floor Furnaces
- ANSI Z21.49--1989 Standard for Gas-Fired Gravity and Fan Type
Vented Wall Furnaces
- ANSI Z21.56--1989 Standards for Gas-Fired Swimming Pool Heaters

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ANSI Z83.9-86 Gas-Fired Duct Furnaces
ANSI Z83.8-85 Gas Unit Heaters

Available from: American Gas Association Laboratories
8501 East Pleasant Valley Road
Cleveland, OH 44131
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AMERICAN SOCIETY FOR TESTING AND MATERIALS

ASTM E283-91 Standard Method of Test for Air Leakage
Through Exterior Windows, Curtain Walls, and
Doors

ASTM C-177-85 Standard Test Method for Steady State Heat
Flux Measurements and Thermal Transmission
Properties by Means of the Guarded Hot Plate
Apparatus

ASTM C-518-85 Standard Test Method for Steady-State Heat
Flux Measurements and Thermal Transmission
Properties by Means of the Heat Flow Meter
Apparatus

ASTM C-271 Standard Test Method for Water Absorption of
Core Materials for Structural Sandwich
Constructions

ASTM E-96-90 Standard Test Methods for Water Vapor
Transmission of Materials

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Philadelphia, PA 19103
(215) 299-5400

AMERICAN NATIONAL STANDARDS/UNDERWRITER'S LABORATORIES

ANSI/U.L. 726-75 Oil-Fired Boiler Assemblies
ANSI/U.L. 727-86 Oil-Fired Control Furnaces

U.L. 731-88 Oil-Fired Unit Heaters
U.L. 795-72 Commercial-Industrial Gas-Heating Equipment,
(R-1986)

Available from: Underwriters Laboratories
Northbrook, IL 60062

AMERICAN SOCIETY OF MECHANICAL ENGINEERS

ANSI/ASME PTC 4.1-64 Steam Generating Units

Available from: ANSI
New York, NY 10017

CODE OF FEDERAL REGULATIONS

10 CFR, Part 430, Appendix N
21 CFR, Section 1002.10 (1990)
47 CFR, Part 5 (1989)

Available from: Department of Energy
Washington, DC 20585

COOLING TOWER INSTITUTE

CTI-201 (86) Certification Standard for Commercial Water
Cooling Towers

Available from: Cooling Tower Institute
P. O. Box 73383
Houston, TX 77273

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HYDRONICS INSTITUTE

HI Heating Boiler Standard 86

Available from: Hydronics Institute
Berkeley Heights, NJ 07922

ASSOCIATED AIR BALANCE COUNCIL

AABC National Standards 4th Edition 1982

Available from: Associated Air Balance Council
1133 15th St., NW
Washington, DC 20005

NEEB Procedural Standards (1983)

SHEET METAL & AIR CONDITIONING CONTRACTORS NATIONAL ASSOCIATION

HVAC Duct Construction Standards - Metal and Flexible, 1985

Available from: SHEET METAL & AIR CONDITIONING CONTRACTORS
NATIONAL ASSOCIATION

NATIONAL FENESTRATION RATING COUNCIL

NFRC Interim U-Value Rating Procedure, March 1991.

Available from: National Fenestration Rating Council
c/o D&R International, Ltd.
962 Wayne Avenue, Suite 750
Silver Spring, MD 20910
(301) 588-0854

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