

Joint Appendix JA1

Appendix JA1 – Glossary

Term	Definition
ACCA	is the Air Conditioning Contractors of America.
ACCA MANUAL J	is the Air Conditioning Contractors of America document entitled “Manual J - Residential Load Calculation, Eighth Edition” (2003).
ACCENT (LIGHT)	is a directional luminaire designed to highlight or spotlight objects. It can be recessed, surface mounted, or mounted to a pendant, stem, or track.
ACCEPTANCE REQUIREMENTS FOR CODE COMPLIANCE	is a description of test procedures in the Reference Nonresidential Appendices that includes equipment and systems to be tested, functions to be tested, conditions under which the test shall be performed, the scope of the tests, results to be obtained, and measurable criteria for acceptable performance.
ACCESSIBLE	is having access thereto, but which first may require removal or opening of access panels, doors, or similar obstructions.
ACM	See <i>Alternative Calculation Method</i> .
ACP	See <i>Alternative Component Package</i> .
ADDITION	is any change to a building that increases conditioned floor area and conditioned volume. Addition is also any change that increases the floor area or volume of an unconditioned building of an occupancy group or type regulated by Part 6. Addition is also any change that increases the illuminated area of an outdoor lighting application regulated by Part 6. See <i>Newly Conditioned Space</i> .
AFUE	See <i>Annual Fuel Utilization Efficiency</i> .
AGRICULTURAL BUILDING	is a structure designed and constructed to house farm implements, hay, grain, poultry, livestock or other horticultural products. It is not a structure that is a place of human habitation, a place of employment where agricultural products are processed, treated or packaged, or a place used by the public.

Term	Definition
<u>AIR BARRIER</u>	<p><u>is combination of interconnected materials and assemblies joined and sealed together to provide a continuous air-tight boundary of the building envelope separating conditioned from unconditioned space, or adjoining conditioned spaces of different occupancies or uses. Insulation must be in substantial contact with the assembly air barrier on one side for it to perform at its rated R-value.</u></p> <p>is combination of interconnected materials and assemblies joined and sealed together to provide a continuous air-tight boundary of the building envelope separating conditioned from unconditioned space, or adjoining conditioned spaces of different occupancies or uses. Insulation must be in substantial contact with the assembly air barrier on one side for it to perform at its rated R-value.</p>
<u>AIR LEAKAGE</u>	<p><u>Is a measure of how much outside air comes into a home or building through a manufactured fenestration or exterior door products. The lower the Air Leakage, the better the fenestration or exterior product is at keeping air out. Air leakage rates typically fall in a range between 0.1 and 0.3 cfm/ft².</u></p>
AIR POROSITY	<p>is a measure of the air-tightness of infiltration barriers in units of cubic feet per hour per square foot per inch of mercury pressure difference.</p>
AIRFLOW ACROSS THE EVAPORATOR	<p>is the rate of airflow, usually measured in cfm across a heating or cooling coil. The efficiency of air conditioners and heat pumps is affected by the airflow across the evaporator (or condenser in the case of a heat pump).</p> <p>See <i>Thermostatic Expansion Valves (TXV)</i>.</p>
AIR-TO-AIR HEAT EXCHANGER	<p>is a device which will reduce the heat losses or gains that occur when a building is mechanically ventilated, by transferring heat between the conditioned air being exhausted and outside air being supplied.</p>
ALTERATION	<p>is any change to a building's water-heating system, space-conditioning system, lighting system, or envelope that is not an addition. Alteration is also any change that is regulated by Part 6 to an outdoor lighting system that is not an addition. Alteration is also any change that is regulated by Part 6 to signs located either indoors or outdoors.</p>
ALTERNATIVE CALCULATION METHOD (ACM)S APPROVAL MANUAL <u>or ACM APPROVAL MANUAL</u>	<p>is the document that specifies the procedures and tests required for approval of Alternative Calculation Methods. <u>establishes the requirements for Energy Commission approval of performance software used to show compliance with the Building Energy Efficiency Standards for Residential and Nonresidential Buildings.</u></p>

Term	Definition
<u>ALTERNATIVE CALCULATION METHOD (ACM) REFERENCE MANUAL or ACM REFERENCE MANUAL</u>	<u>contains the specific procedures to implement Sections 140.1 and 150.1 of Title 24, Part 6 of the California Code of Regulations in Compliance Software.</u>
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. ACMS are also referred to as compliance software.
ALTERED COMPONENT	is a component that has undergone an alteration and is subject to all applicable Standards requirements.
ALTERNATIVE COMPONENT PACKAGE	is one of the sets of low-rise residential prescriptive requirements contained in §151(f). Each package is a set of measures that achieve a level of performance that meets the Standards. These are often referred to as the prescriptive packages or 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 Standards Tables 151-B, 151-C and 151-D for the appropriate climate zone..." <u>is a set of building measures whose aggregate calculated energy use is less than or equal to the maximum allowed Energy Budget.</u>
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 §112.
ANNUNCIATED	is a type of visual signaling device that indicates the on, off, or other status of a load.
ANSI	is the American National Standards Institute.
ANSI C82.6-2005	is the American National Standards Institute document entitled "Ballasts for High-Intensity Discharge Lamps – Methods of Measurement" (ANSI C82.6-2005)
<u>ANSI/IES RP-16-10</u>	<u>is the document co-authored by the American National Standards Institute and the Illuminating Engineering Society of North America, Recommended Practice entitled "Nomenclature and Definitions for Illuminating Engineering" (Supersedes ANSI/IES RP-16-05) Includes ANSI/IES Addenda listed in Annex B, 2010 (ANSI/IES RP-16-10)</u>
ANSI Z21.10.3	is the American National Standards Institute document entitled "Gas Water Heaters, Volume I, Storage Water Heaters with input ratings above 75,000 Btu per hour," 2001 (ANSI Z21.10.3-2001).
ANSI Z21.13	is the American National Standards Institute document entitled "Gas-Fired Low Pressure Steam and Hot Water Boilers," 2000 (ANSI Z21.13-2000).

Term	Definition
ANSI Z21.40.4	is the American National Standards Institute document entitled "Performance Testing and Rating of Gas-Fired, Air Conditioning and Heat Pump Appliances," 1996 (ANSI Z21.40.4-1996).
ANSI Z21.47	is the American National Standards Institute document entitled "Gas-Fired Central Furnaces," 2001 (ANSI Z21.47-2001).
ANSI Z83.8	is the American National Standards Institute document entitled "Gas Unit Heaters and Gas-Fired Duct Furnaces," 2002 (ANSI Z83.8 -2002).
APPLIANCE EFFICIENCY REGULATIONS	are the regulations in Title 20, Section 1601 et seq. of the California Code of Regulations.
APPLIANCE STANDARDS	are the Standards contained in the Appliance Efficiency Regulations.
APPROVED	as to a home energy rating provider or home energy rating system, is reviewed and approved by the Commission under Title 20, Section 1675 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. is compliance software, or alternative component packages, or exceptional methods approved under Section 10-109
AREAL HEAT CAPACITY	See <i>Heat Capacity</i> .
AHRI	is the Air- C onditioning, H eating, and Refrigeration Institute.
AHRI 210/240	is the Air- C onditioning, H eating, and Refrigeration Institute document entitled "Unitary Air-Conditioning and Air-Source Heat Pump Equipment," 2003 (ARI 210/240-2003).
AHRI 310/380	is the Air- C onditioning, H eating, and Refrigeration Institute document entitled "Packaged Terminal Air-Conditioners and Heat Pumps," 1993 (ARI 310/380-93).
AHRI 320	is the Air- C onditioning, H eating, and Refrigeration Institute document entitled "Water-Source Heat Pumps," 1998 (ARI 320-98).
AHRI 325	is the Air- C onditioning, H eating, and Refrigeration Institute document entitled "Ground Water-Source Heat Pumps," 1998 (ARI 325-98).
AHRI 340/360	is the Air- C onditioning, H eating and Refrigeration Institute document entitled "Commercial and Industrial Unitary Air-Conditioning and Heat Pump Equipment," 2000 (ARI 340/360-2000).
AHRI 365	is the Air- C onditioning, H eating and Refrigeration Institute document entitled, "Commercial and Industrial Unitary Air-Conditioning Condensing Units," 2002 (ARI 365-2002).

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<u>AHRI 460</u>	is the Air- C onditioning, H eating, and Refrigeration Institute document entitled "Remote Mechanical-Draft Air-Cooled Refrigerant Condensers," 2000 (ARI 460-2000).
<u>AHRI 550/590</u>	is the Air- e Conditioning, H eating, and Refrigeration Institute document entitled "Standard for Water Chilling Packages Using the Vapor Compression Cycle," 1998 (ARI 550/590-98).
<u>AHRI 560</u>	is the Air- C onditioning, H eating, and Refrigeration Institute document entitled "Absorption Water Chilling and Water Heating Packages," 2000 (ARI 560-2000).
<u>AHRI 680</u>	<u>is the Air-Conditioning, Heating, and Refrigeration Institute document entitled "Performance Rating of Residential Air Filter Equipment," 2009 (ANSI/AHRI Standard 680).</u>
ASHRAE	is the American Society of Heating, Refrigerating, and Air-conditioning Engineers.
<i>ASHRAE CLIMATIC DATA FOR REGION X</i>	is the American Society of Heating, Refrigerating and Air-Conditioning Engineers document entitled "ASHRAE Climatic Data for Region X, Arizona, California, Hawaii and Nevada," Publication SPCDX, 1982 and "Supplement," 1994.
<i>ASHRAE HANDBOOK, APPLICATIONS VOLUME</i>	is the American Society of Heating, Refrigerating and Air-Conditioning Engineers document entitled "ASHRAE Handbook: Heating, Ventilating, and Air-Conditioning Applications" (2003).
<i>ASHRAE HANDBOOK, EQUIPMENT VOLUME</i>	is the American Society of Heating, Refrigerating and Air-Conditioning Engineers document entitled "ASHRAE Handbook: Heating, Ventilating, and Air-Conditioning Systems and Equipment" (2000).
<i>ASHRAE HANDBOOK, FUNDAMENTALS VOLUME</i>	is the American Society of Heating, Refrigerating and Air-Conditioning Engineers document entitled "ASHRAE Handbook: Fundamentals" (2001).
<u>ASHRAE STANDARD 52.2</u>	<u>is the American Society of Heating, Refrigerating and Air-Conditioning Engineers document entitled "Method of Testing General Ventilation Air-Cleaning Devices for Removal Efficiency by Particle Size," 2007 (ANSI/ASHRAE Standard 52.2-2007 including ANSI/ASHRAE Addendum b to ANSI/ASHRAE Standard 52.2-2007).</u>
<i>ASHRAE STANDARD 55</i>	is the American Society of Heating, Refrigerating and Air-Conditioning Engineers document entitled "Thermal Environmental Conditions for Human Occupancy," 2004 (ASHRAE Standard 55-2004).

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ASHRAE STANDARD 62.2	is the American Society of Heating, Refrigerating and Air-Conditioning Engineers document entitled "Ventilation and Acceptable Indoor Air Quality in Low-Rise Residential Buildings," 2010 (ANSI/ASHRAE Standard 62.2-2010 including ANSI/ASHRAE Addenda b, c, e, g, h, i and l to ANSI/ASHRAE 62.2-2010 published in the 2011 supplement. 2007 (ASHRAE Standard 62.2-2007).
ASME	is the American Society of Mechanical Engineers.
ASTM	is the American Society for Testing and Materials.
ASTM C1167	is the American Society for Testing and Materials document entitled "Standard Specification for Clay Roof Tiles," 1996 (ASTM C1167-96).
ASTM C1371	is the American Society for Testing and Materials document entitled "Standard Test Method for Determination of Emittance of Materials Near Room Temperature Using Portable Emitters," 1998 (ASTM C1371-98).
ASTM C1583	is the American Society of Testing and Materials document entitled, "Standard Test Method for Tensile Strength of Concrete Surfaces and the Bond Strength or Tensile Strength of Concrete Repair and Overlay Materials by Direct Tension (Pull-off Method)," 2004 (ASTM C1583-04).
ASTM C177	is the American Society for Testing and Materials document entitled "Standard Test Method for Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Guarded-Hot-Plate Apparatus," 1997 (ASTM C177-97).
ASTM C272	is the American Society for Testing and Materials document entitled "Standard Test Method for Water Absorption of Core Materials for Structural Sandwich Constructions," 2001 (ASTM C272-01).
ASTM C335	is the American Society for Testing and Materials document entitled "Standard Test Method for Steady-State Heat Transfer Properties of Horizontal Pipe Insulation," 1995 (ASTM C335-95).
ASTM C518	is the American Society for Testing and Materials document entitled "Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus," 2002 (ASTM C518-02).
ASTM C55	is the American Society for Testing and Materials document entitled "Standard Specification for Concrete Brick," 2001 (ASTM C55-01).
ASTM C731	is the American Society for Testing and Materials document entitled "Standard Test Method for Extrudability, After Package Aging of Latex Sealants," 2000 (ASTM C731-00).

Term	Definition
<i>ASTM C732</i>	is the American Society for Testing and Materials document entitled "Standard Test Method for Aging Effects of Artificial Weathering on Latex Sealants," 2001 (ASTM C732-01).
<i>ASTM C836</i>	is the American Society of Testing and Materials document entitled, "Standard Specification for High Solids Content, Cold Liquid-Applied Elastomeric Waterproofing Membrane for Use with Separate Wearing Course," 2005 (ASTM C836-05).
<i>ASTM D1003</i>	is the American Society for Testing and Materials document entitled "Standard Test Method for Haze and Luminous Transmittance of Transparent Plastics," 2000 (ANSI/ASTM D1003-00).
<i>ASTM D1653</i>	is the American Society of Testing and Materials document entitled, "Standard Test Methods for Water Vapor Transmission of Organic Coating Films," 2003 (ASTM D1653-03).
<i>ASTM D2370</i>	is the American Society of Testing and Materials document entitled, "Standard Test Method for Tensile Properties of Organic Coatings," 2002 [ASTM D2370-98 (2002)].
<i>ASTM D2824</i>	is the American Society of Testing and Materials document entitled "Standard Specification for Aluminum-Pigmented Asphalt Roof Coatings, Nonfibered, Asbestos Fibered, and Fibered without Asbestos," 2002 (ASTM D2824-02).
<i>ASTM D3468</i>	is the American Society of Testing and Materials document entitled, "Standard Specification for Liquid-Applied Neoprene and Chlorosulfonated Polyethylene Used in Roofing and Waterproofing," 1999 (ASTM D3468-99).
<i>ASTM D3805</i>	is the American Society of Testing and Materials document entitled "Standard Guide for Application of Aluminum-Pigmented Asphalt Roof Coatings," 1997 (ASTM D3805-97 (reapproved 2003)).
<i>ASTM D4798</i>	is the American Society for Testing and Materials document entitled "Standard Test Method for Accelerated Weathering Test Conditions and Procedures for Bituminous Materials (Xenon-Arc Method)," 2001 (ASTM D4798-01).
<i>ASTM D522</i>	is the American Society of Testing and Materials document entitled, "Standard Test Methods for Mandrel Bend Test of Attached Organic Coatings," 2001 [ASTM D522-93a (2001)].
<i>ASTM D822</i>	is the American Society of Testing and Materials document entitled, "Standard Test Methods for Mandrel Bend Test of Attached Organic Coatings," 2001 [ASTM D522-93a (2001)].

Term	Definition
ASTM D5870	is the American Society of Testing and Materials document entitled, "Standard Practice for Calculating Property Retention Index of Plastics," 2003 [ASTM D5870-95 (2003)].
ASTM D6083	is the American Society of Testing and Materials document entitled, "Standard Specification for Liquid Applied Acrylic Coating Used in Roofing," 2005 (ASTM D6083-05e1).
ASTM D6694	is the American Society of Testing and Materials document entitled, "Standard Specification for Liquid-Applied Silicone Coating Used in Spray Polyurethane Foam Roofing," 2001 (ASTM D6694-01).
ASTM D6848	is the American Society of Testing and Materials document entitled "Standard Specification for Aluminum-Pigmented Emulsified Asphalt Used as a Protective Coating for Roofing," 2002 (ASTM D6848-02).
ASTM D822	is the American Society of Testing and Materials document entitled, "Standard Practice for Filtered Open-Flame Carbon-Arc Exposures of Paint and Related Coatings," 2001 (ASTM D822-01).
ASTM E96	is the American Society for Testing and Materials document entitled "Standard Test Methods for Water Vapor Transmission of Materials," 200 (ASTM E96-00).
ASTM E283	is the American Society for Testing and Materials document entitled "Standard Test Method for Determining the Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen," 1991 (ASTM E283-91(1999)).
ASTM E408	is the American Society for Testing and Materials document entitled, "Standard Test Methods for Total Normal Emittance of Surfaces Using Inspection-Meter Techniques," 1971 (ASTM E408-71(2002)).
ASTM E96	is the American Society for Testing and Materials document entitled "Standard Test Methods for Water Vapor Transmission of Materials," 200 (ASTM E96-00).
<u>ASTM E972</u>	<u>is the American Society for Testing and Materials document entitled, "Standard Test Method for Solar Photometric Transmittance of Sheet Materials Using Sunlight," 1996 (ASTM E972-96(2007)).</u>
<u>ASTM E2178-03</u>	<u>is the American Society for Testing and Materials document entitled, "Standards Test Method for Air Permeance of Building Materials.</u>
<u>ASTM E2357-05</u>	<u>is the American Society for Testing and Materials document entitled, "Standard Test Method for determining air leakage of air barrier assemblies.</u>

Term	Definition
ATRIUM	is a large-volume space created by openings connecting two or more stories and is used for purposes other than an enclosed stairway, an elevator hoist way, an escalator opening, or as a utility shaft for plumbing, electrical, air-conditioning or other equipment, and is not a mall.
ATTIC	is an enclosed unconditioned space directly below the roof <u>deck</u> and above the ceiling <u>beams</u> .
AUDITORIUM	See <i>Nonresidential Functional Area or Type of Use</i> .
AUTO REPAIR	See <i>Nonresidential Functional Area or Type of Use</i> .
AUTOMATED TELLER MACHINE (ATM)	is any electronic information processing device which accepts or dispenses currency in connection with a credit, deposit, or convenience account without involvement by a clerk.
AUTOMATIC	is capable of operating without human intervention.
AUTOMATIC MULTI-LEVEL DAYLIGHTING CONTROL	is a multi-level lighting control that automatically reduces lighting in multiple steps or continuous dimming in response to available daylight. This control uses one or more photosensors to detect changes in daylight illumination and then change the electric lighting level in response to the daylight changes.
AUTOMATIC TIME SWITCH CONTROL DEVICES	are devices capable of automatically turning loads off and on based on time schedules.
BACK	is the back side of the building as one faces the front façade from the outside (see Front). This designation is used on the Certificate of Compliance (CF-1R form) to indicate the orientation of fenestration (e.g., Back-West).
BATHROOM	See <i>Residential Space Type</i>.
BELOW-GRADE WALL	is the portion of a wall, enclosing conditioned space that is below the grade line.
BRITISH THERMAL UNIT (BTU)	is the amount of heat needed to raise the temperature of one pound of water one degree Fahrenheit.
BTU/H	is the amount of heat in Btu that is removed or added during one hour. Used for measuring heating and cooling equipment output.
<u>BUBBLE POINT</u>	<u>is the refrigerant liquid saturation temperature at a specified pressure.</u>
BUILDER	is the general contractor responsible for construction
BUILDING	is any structure or space covered by Section 100.0 of the Building Energy Efficiency Standards.
<u>BUILDING COMMISSIONING</u>	<u>is a systematic quality assurance process that spans the entire design and construction process, including verifying and documenting that building systems and components are planned, designed, installed, tested, operated and maintained to meet the owner's project requirements.</u>

Term	Definition
<i>ENFORCEMENT AGENCY</i>	is the city, county or state agency responsible for approving the plans, issuing a building permit and approving occupancy of the dwelling unit.
<i>BUILDING ENERGY EFFICIENCY STANDARDS</i>	are the California Building Energy Efficiency Standards as set forth in the California Code of Regulations, Title 24, Part 6. Also known as the <i>California Energy Code</i> .
<i>BUILDING ENTRANCE</i>	See <i>Outdoor Lighting</i> .
<i>BUILDING ENVELOPE</i>	is the ensemble of exterior and demising partitions of a building that enclose conditioned space.
<i>BUILDING FAÇADE</i>	See <i>Outdoor Lighting</i> .
<i>BUILDING LOCATION DATA</i>	is the specific outdoor design temperatures shown in Reference Joint Appendix JA2 used in calculating heating and cooling loads for the particular location of the building.
<i>BUILDING OWNER</i>	is the owner of the building or dwelling unit.
<i>BUILDING PERMIT</i>	is 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.
<i>BUILDING TYPES</i>	is the classification of buildings defined by the CBC and applicable to the requirements of the <i>Building Energy Efficiency Standards</i> .
<i>CABINET SIGN</i>	See <i>Sign</i> .
<i>CALIFORNIA ELECTRICAL CODE</i>	is the 2007 California Electrical Code.
<i>CALIFORNIA ENERGY CODE</i>	See <i>Building Energy Efficiency Standards</i> .
<i>CALL CENTER</i>	is a phone center that handles large number of phone calls including but not limited to help desk, customer and sales support, technical support, emergency response, telephone answering service, and inbound and outbound telemarketing.
<i>CANOPY</i>	See <i>Outdoor Lighting</i> .
<i>CAPTIVE-KEY OVERRIDE</i>	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.
<i>CBC</i>	is the 2007 California Building Code.
<i>CEILING</i>	is the interior upper surface of a space separating it from an attic, plenum, indirectly or directly conditioned space or the roof assembly, which has a slope less than 60 degrees from horizontal.
<i>CENTER OF GLASS U-FACTOR</i>	is the U-factor for the glass portion only of vertical or horizontal fenestration and is measured at least two and one half inches from the frame. Center of glass U-factor does not consider the U-factor of the frame. Center of glass U-factor is not used in Title 24 compliance.

Term	Definition
CENTRAL FAN-INTEGRATED VENTILATION SYSTEM	is a central forced air heating and/or cooling system which is intended to operate on a regular basis to bring in outdoor ventilation air and/or distribute air around the home for comfort and ventilation even when heating and cooling are not needed.
CERTIFICATE OF COMPLIANCE	is a document with information required by the Commission that is prepared by the Documentation Author that indicates whether the building includes measures that require field verification and diagnostic testing.
CERTIFICATE OF FIELD VERIFICATION AND DIAGNOSTIC TESTING	is a document with information required by the Commission that is prepared by the HERS Rater to certify that measures requiring field verification and diagnostic testing comply with the requirements.
CERTIFICATION	is certification by the manufacturer to the Commission, as specified the Appliance Efficiency Regulations, that the appliance complies with the applicable standard for that appliance. The Commission's database of certified heating appliances can be accessed by contacting the Commission Energy Hotline or from the Commission's website at http://www.energy.ca.gov/appliances/database/ The term certification is also used in other ways in the standards. Many of the compliance forms are certificates, whereby installers, HERS testers and others certify that equipment was correctly installed and/or tested.
CERTIFIED	as to a home energy rater, is having been found by a certified home energy rating provider to have successfully completed the requirements established by that home energy rating provider.
<u>CERTIFIED TO THE ENERGY COMMISSION</u>	<u>means certified to the California Energy Commission pursuant to the provisions of Section 1606 of Title 20 of the California Code of Regulations.</u>
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.
CHANDELIER	is a ceiling-mounted, close-to-ceiling, or suspended decorative luminaire that uses glass, crystal, ornamental metals, or other decorative material and that typically is used in hotel/motels, restaurants, or churches as a significant element in the interior architecture
CHANNEL LETTER SIGN	See <i>Sign</i>
CIVIC MEETING SPACE	See <i>Nonresidential Functional Area or Type of Use.</i>
CLASSROOM, LECTURE, TRAINING, VOCATIONAL ROOM	See <i>Nonresidential Functional Area or Type of Use.</i>

Term	Definition
CLIMATE ZONES	are the 16 geographic areas of California for which the Commission has established typical weather data, prescriptive packages and energy budgets. Climate zones are defined by ZIP code and referenced in Joint Appendix JA2 . Climate zone boundary descriptions are in the document "California Climate Zone Descriptions" (July 1995), incorporated herein by reference. FIGURE 100.1-A in the Building Energy Efficiency Standards is an approximate map of the 16 climate zones.
CLOSED-CIRCUIT COOLING TOWER	is a closed-circuit cooling tower that utilizes indirect contact between a heated fluid, typically water or glycol, and the cooling atmosphere to transfer the source heat load indirectly to the air, essentially combining a heat exchanger and cooling tower into one relatively compact device.
CLTD	is the Cooling Load Temperature Difference.
CMC	is the 2007 California Mechanical Code.
CODEC, CEC	is the 2007 California Electric Code.
CODES, CALIFORNIA HISTORICAL BUILDING CODE	is the California Historical Building Code, California Code of Regulations, Title 24, Part 8 and Part 2 (Chapter 34).
CODES, CBC	is the 2007 California Building Code.
CODES, CEC	is the 2007 California Electric Code.
CODES, CMC	is the 2007 California Mechanical Code.
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 §112.
COEFFICIENT OF PERFORMANCE (COP), HEAT PUMP	is the ratio of the rate of useful heat output delivered by the complete heat pump unit (exclusive of supplementary heating) to the corresponding rate of energy input, in consistent units and as determined using the applicable test method in Appliance Efficiency Regulations or §112.
COEFFICIENT OF PERFORMANCE (COP), HEATING	is the ratio of the rate of useful heat output delivered by the complete heat pump unit (exclusive of supplementary heating) to the corresponding rate of energy input, in consistent units, and as determined using the applicable test method in the Appliance Efficiency Regulations or §112.
COMBINATION SPACE-HEATING AND WATER-HEATING APPLIANCE	is an appliance that is designed to provide both space heating and water heating from a single primary energy source.

Term	Definition
COMBINED HYDRONIC SPACE/WATER HEATING SYSTEM	is a system which both domestic hot water and space heating is supplied from the same water heating equipment. Combined hydronic space heating may include both radiant floor systems and convective or fan coil systems.
COMBUSTION EFFICIENCY	is a measure of the percentage of heat from the combustion of gas or oil that is transferred to the medium being heated or lost as jacket loss.
COMMISSION	is the California State Energy Resources Conservation and Development Commission.
COMPLETE BUILDING	See <i>Entire Building</i> .
<u>COMPLEX MECHANICAL SYSTEMS</u>	<u>are systems that include 1) fan systems each serving multiple thermostatically controlled zones, or 2) built-up air handler systems (non-unitary or non-packaged HVAC equipment), or 3) hydronic or steam heating systems, or 4) hydronic cooling systems. Complex systems are NOT the following: unitary or packaged equipment listed in Tables 110.2-A, 110.2-B, 110.2-C, and 110.2-E that each serve one zone or two-pipe, heating only systems serving one or more zones.</u>
COMPLIANCE APPROACH	is 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 §100.0(e)2Dii.
COMPLIANCE DOCUMENTATION	are the set of forms and other data prepared in order to demonstrate to the building official that a building complies with the Standards. The compliance forms for the residential and nonresidential standards are contained in the Residential Compliance Manual and the Nonresidential Compliance Manual.
<u>COMPLIANCE OPTION</u>	<u>is a method or procedure for demonstrating compliance with Title 24, Part 6 and Part 11, Division 4.2 and 5.2 of the California Code of Regulations through modifications of approved calculation methods.</u>
<u>COMPLIANCE SOFTWARE</u>	<u>is used to demonstrate compliance with the performance approach to the California Energy Efficiency Standards. The compliance software must meet the requirements for certification described in the Alternative Calculation Method Manual.</u>
COMPONENT METHOD APPROACH	This certification program rates whole fenestration products in accordance with NFRC 100. In order to accomplish this, the three (3) components that make up a fenestration product shall have values that are NFRC-approved and maintained in the NFRC Approved Component Library Database.

Term	Definition
<u>COMPUTER ROOM</u>	is a room whose primary function is to house electronic equipment and that has a design equipment power density exceeding 20 watts/ft ² of conditioned floor area (215 watts/m ²).
<u>CONDENSER SPECIFIC EFFICIENCY</u>	is the Total Heat of Rejection (THR) capacity divided by the fan input electric power at 100% fan speed (including spray pump electric input power for evaporative condensers).
CONDITIONED FLOOR AREA (CFA)	is the floor area in square feet (ft ²) of enclosed conditioned space on all floors of a building, as measured at the floor level of the exterior surfaces of exterior walls enclosing the conditioned space.
CONDITIONED FOOTPRINT	is a projection of all conditioned space on all floors to a vertical plane. The conditioned footprint area may be equal to the first floor area, or it may be greater, if upper floors project over lower floors. One way to think of the conditioned footprint area is as the area of the largest conditioned floor in the building plus the conditioned floor area of any projections from other stories that extend beyond the outline of that largest floor.
CONDITIONED SPACE	is space in a building that is either directly conditioned or indirectly conditioned.
CONDITIONED SPACE, DIRECTLY	is an enclosed space that is provided with wood heating, is provided with mechanical heating that has a capacity exceeding 10 Btu/hr-ft ² , or is provided with mechanical cooling that has a capacity exceeding 5 Btu/hr-ft ² ; unless the space conditioning system is designed for a process space. (See "Process space")
CONDITIONED SPACE, INDIRECTLY	is enclosed space, including, but not limited to, unconditioned volume in atria, that (1) is not directly conditioned space; and (2) either (a) has a thermal transmittance area product (UA) to directly conditioned space exceeding that to the outdoors or to unconditioned space and does not have fixed vents or openings to the outdoors or to unconditioned space, or (b) is a space through which air from directly conditioned spaces is transferred at a rate exceeding three air changes per hour.
CONDITIONED VOLUME	is the total volume in cubic feet (ft ³) of the conditioned space within a building.
CONSTRUCTION LAYERS	are roof, wall and floor constructions which represent an assembly of layers. Some layers are homogeneous, such as gypsum board and plywood sheathing, while other layers are non-homogeneous such as the combination of wood framing and cavity insulation typical in many buildings.
<u>CONTINUOUS AIR BARRIER</u>	<u>See Air Barrier</u>
CONTINUOUS DIMMING	See <i>Dimming, Continuous.</i>

Term	Definition
<u>CONTINUOUS INSULATION</u>	Exterior or interior of board, sheet, insulated siding, or field applied material that is continuous across all structural or nonstructural framing assemblies separating conditioned from unconditioned space without thermal bridges other than fasteners and necessary building penetrations.
<u>CONTROLLED ATMOSPHERE</u>	is an airtight space maintained at reduced oxygen levels for the purpose of reducing respiration of perishable product in long term storage.
CONTROLLED VENTILATION CRAWL SPACE (CVC)	is a crawl space in a residential building where the side walls of the crawlspace are insulated rather than the floor above the crawlspace. A CVC has automatically controlled crawl space vents. Credit for a CVC is permitted for low-rise residential buildings that use the performance approach to compliance.
CONVENTION CENTERS	See <i>Nonresidential Functional Area or Type of Use</i> .
COOL ROOF	is a roofing material with high thermal emittance and high solar reflectance, or low thermal emittance and exceptionally high solar reflectance as specified in §110.8(i) that reduces heat gain through the roof.
COOL ROOF RATING COUNCIL (CRRC)	is a not-for-profit organization designated by the Commission as the Supervisory Entity with responsibility to rate and label the reflectance and emittance of roof products.
COOLING COIL AIRFLOW	Is the air flow through the evaporator (indoor) coil of a direct expansion air conditioning unit in cooling mode. The air flow is expressed in cubic feet per minute (CFM) or liter per second (L/S) of standard air (standard air has a density of 0.075 lb/ft ³).
COOLING EQUIPMENT	is equipment used to provide mechanical cooling for a room or rooms in a building.
COOLING LOAD	is the rate at which heat must be extracted from a space to maintain a desired room condition.
COOLING LOAD TEMPERATURE DIFFERENCE (CLTD)	is an equivalent temperature difference used for calculating the instantaneous external cooling loads across a wall or roof. The cooling load is the CLTD x U-factor x Area.
COP	See <i>Coefficient of Performance</i> .
CORRIDOR	See <i>Nonresidential Functional Area or Type of Use</i> .
COURTYARD	is an open space through one or more floor levels surrounded by walls within a building.
CRAWL SPACE	is a space immediately under the first floor of a building adjacent to grade.
CRRC	See <i>Cool Roof Rating Council</i> .
CRRC-1	is the Cool Roof Rating Council document entitled "Product Rating Program Manual." (2002)
CTI	is the Cooling Technology Institute.

Term	Definition
CTI ATC-105	is the Cooling Technology Institute document entitled "Acceptance Test Code for Water Cooling Towers," 2000 (CTI ATC-105-00).
<u>CTI ATC-105S(96)</u>	<u>is the Cooling Technology Institute document entitled "Acceptance Test Code for Closed-Circuit Cooling Towers," 1996 (CTI ATC-105-96).</u>
CTI STD-201	is the Cooling Technology Institute document entitled "Standard for the Certification of Water-Cooling Tower Thermal Performance," 2004 (CTI STD-201-04).
CURTAIN WALL	is an external nonbearing wall intended to separate the exterior and interior environments, which may consist entirely (or principally) of a combination of framing materials, glass and glazing, opaque in-fill and other surfacing materials supported by (or within) a framework.
<u>CURRENT AIR DEMAND</u>	<u>is a measurement of total airflow, measured in actual cubic feet of air per minute (acfm), necessary for end uses in a compressed air system.</u>
CUSTOM ENERGY BUDGET	See <i>Energy Budget</i> .
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.
<u>CYCLES OF CONCENTRATION</u>	<u>Cycles of concentration is a measurement of the concentration of total dissolved solids (TDS) in tower water. Because evaporation of pure water leaves dissolved solids behind in the system water, TDS increases over time as the tower operates. The number of times the dissolved minerals are concentrated is relative to the TDS in the makeup water. For example, 5 cycles of concentration represents five times the concentration of solids in the tower system water relative to the TDS in the make up water entering the tower.</u>
DAYLIGHT AREA <u>DAYLIT ZONE</u>	is the floor area under skylights or next to windows. The <u>Daylit Zone</u> daylight area includes Primary Sidelit <u>Daylit Zone</u> Daylight Area, Secondary Sidelit <u>Daylit Zone</u> Daylight Area, and Skylit <u>Daylit Zone</u> Daylight Area.

Term	Definition
<u>DATA REGISTRY</u>	<p>is a web service with a user interface and database maintained by a Registration Provider that provides for registration of residential or nonresidential compliance documentation used for demonstrating compliance with Part 6. Data registries shall conform to the requirements specified in Reference Joint Appendix JA7 and the Commission-approved Data Registry Requirements Manual.</p> <p>RESIDENTIAL DATA REGISTRY is a HERS provider data registry approved by the Energy Commission.</p> <p>NONRESIDENTIAL DATA REGISTRY is a HERS provider data registry approved by the Energy Commission, or a data registry approved by the Executive Director.</p>
<u>DATA REGISTRY REQUIREMENTS MANUAL</u>	<p>is a document that provides additional detail specification for data registry requirements necessary to supplement the requirements in Reference Joint Appendix JA7. The Data Registry Requirements Reference Manual may be approved by the Energy Commission. Corrections, clarifications, revisions and addendums to the Registry Requirements Reference Manual may be approved by the Executive Director.</p>
DEADBAND	<p>is the temperature range within which the HVAC system is neither calling for heating or cooling.</p>
DECORATIVE GAS APPLIANCE	<p>is a gas appliance that is designed or installed for visual effect only, cannot burn solid wood, and simulates a fire in a fireplace.</p>
DEGREE DAY, HEATING	<p>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 Reference Joint Appendix JA2. For those localities not listed in the Reference Joint Appendix JA2, the number of degree days is as determined by the applicable enforcing agency.</p>

Term	Definition
DEMAND RESPONSE	<p><u>is short-term changes in electric usage by end-use customers, from their normal consumption patterns, in response to:</u></p> <p><u>a. changes in the price of electricity; or</u></p> <p><u>b. participation in programs or services designed to modify electricity use</u></p> <p><u>i. in response to wholesale market prices or</u></p> <p><u>ii. when system reliability is jeopardized.</u></p> <p>controlling electricity loads in buildings in response to an electronic signal sent by the local utility requesting their customers to reduce electricity consumption.</p>
DEMAND RESPONSE PERIOD	<p>is a period of time during which the local utility is curtailing electricity loads <u>are modified in response to</u> by sending out a demand response signal.</p>
DEMAND RESPONSE SIGNAL	<p><u>is a signal sent by the local utility, Independent System Operator (ISO), or designated curtailment service provider or aggregator, to a customer, indicating a price or a request to modify electricity consumption, for a limited time period.</u></p> <p>is an electronic signal sent out by the local utility indicating a request to their customers to curtail electricity consumption.</p>
DEMAND RESPONSIVE LIGHTING CONTROL	<p>is a control that reduces lighting power consumption in response to a demand response signal.</p>
<u>DEMAND RESPONSIVE CONTROL</u>	<p><u>is a kind of control that is capable of receiving and automatically responding to a demand response signal.</u></p>
DEMISING PARTITION	<p>is a wall, fenestration, floor, or ceiling that separates conditioned space from enclosed unconditioned space.</p>
DEMISING WALL	<p>is a wall that is a demising partition.</p>
DENSITY	<p>is the mass per unit volume of a construction material as documented in an ASHRAE handbook, a comparably reliable reference or manufacturer's literature.</p>
DEPLETABLE SOURCES	<p>is energy obtained from electricity purchased from a public utility, or energy obtained from burning coal, oil, natural gas, or liquefied petroleum gases.</p>
DESIGN CONDITIONS	<p>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 §140.4(b) for nonresidential, high-rise residential, and hotel/motel buildings and in §150.0(h) for low-rise residential buildings.</p>
DESIGN HEAT GAIN RATE	<p>is the total calculated heat gain through the building envelope under design conditions.</p>
DESIGN HEAT LOSS RATE	<p>is the total calculated heat loss through the building envelope under design conditions.</p>

Term	Definition
<u>DESIGN REVIEW</u>	is defined as a secondary review of the construction documents (drawings and specifications) that seeks to improve compliance with existing Title 24 regulations, encourage adoption of best practices in design, and encourage designs that are constructable and maintainable. It is an opportunity for an experienced design engineer to look at a project with a fresh perspective in an effort to catch missing or unclear design information and to suggest design enhancements.
<i>DIMMING, CONTINUOUS</i>	is a lighting control method that is capable of varying the light output of lamps over a continuous range from full light output to minimum light output.
<i>DIMMING, STEPPED</i>	is a lighting control method that varies the light output of lamps in one or more predetermined discrete steps between full light output and off.
<u>DEW POINT</u>	is the refrigerant vapor saturation temperature at a specified pressure.
<i>DINING</i>	See <i>Nonresidential Functional Area or Type of Use</i> .
<i>DIRECT DIGITAL CONTROL (DDC)</i>	is a type of control where controlled and monitored analog or binary data, such as temperature and contact closures, are converted to digital format for manipulation and calculations by a digital computer or microprocessor, then converted back to analog or binary form to control mechanical devices.
<i>DIRECTLY CONDITIONED SPACE</i>	is an enclosed space that is provided with wood heating, is provided with mechanical heating that has a capacity exceeding 10 Btu/(hr.xft. ²), or is provided with mechanical cooling that has a capacity exceeding 5 Btu/(hr.xft. ²), unless the space-conditioning system is designed and thermostatically controlled to maintain a process environment temperature less than 55°F or to maintain a process environment temperature greater than 90°F for the whole space that the system serves, or unless the space-conditioning system is designed and controlled to be incapable of operating at temperatures above 55°F or incapable of operating at temperatures below 90°F at design conditions.
<i>DISPLAY LIGHTING</i>	is lighting confined to the area of a display that provides a higher level of illuminance than the level of surrounding ambient illuminance.
<i>DISPLAY PERIMETER</i>	is the length of an exterior wall in a Group B; Group F, Division 1; or Group M Occupancy that immediately abuts a public sidewalk, measured at the sidewalk level for each story that abuts a public sidewalk.
<i>DIVIDERS</i>	are wood, aluminum or vinyl glazing dividers including mullions, muntins, munnions and grilles. Dividers may truly divide lights, be between the panes, or be applied to the exterior or interior of the glazing.

Term	Definition
DOCUMENTATION AUTHOR	is the person completing the compliance documentation that demonstrates whether a building complies with the Standards. Compliance documentation requirements are defined in the Residential Compliance Manual. DOCUMENTATION AUTHOR is the person who prepares a Title 24 Part 6 compliance document (Certificate of Compliance, Certificate of Installation, Certificate of Acceptance, or Certificate of Verification). A documentation author is not required to be eligible under Division 3 of the Business and Professions Code to accept responsibility for the building design and/or construction, and is not required to be a certified HERS rater. A documentation author who is not eligible under the applicable section(s) of Division 3 of the Business and Professions Code shall not accept responsibility for the building design on Certificate of Compliance documentation. A documentation author who is not eligible under the applicable section(s) of Division 3 of the Business and Professions Code shall not accept responsibility for the building construction or installation Certificate of Installation, or Certificate of Acceptance documentation. A documentation author who is not a certified HERS Rater shall not accept responsibility for Field Verification and Diagnostic Testing documentation.
DOMINANT OCCUPANCY	is the occupancy type in mixed occupancy buildings with the greatest percentage of total conditioned floor area.
DOOR	is an operable opening in the building envelope that is not a fenestration product component , including swinging and roll-up doors, fire doors, and access hatches. Doors that are more than one-half glass in area are considered a fenestration product glazed door.
<u>DOOR, GLAZED</u>	<u>Doors that are more than one-half glass in area are considered a glazed door.</u>
DORMITORY	is a building consisting of multiple sleeping quarters and having interior common areas such as dining rooms, reading rooms, exercise rooms, toilet rooms, study rooms, hallways, lobbies, corridors, and stairwells, other than high-rise residential, low-rise residential, and hotel/motel occupancies.
DOUBLE-FACED SIGN	See <i>Sign</i> .
DUAL-GLAZED GREENHOUSE WINDOWS	are a type of dual-glazed fenestration product which adds conditioned volume but not conditioned floor area to a building.
DUCT LOSSES	is heat transfer into or out of a space conditioning system duct through conduction or leakage.

Term	Definition
DUCT SEALING	is a procedure for installing a space conditioning distribution system that minimizes leakage of air from or to the distribution system. Minimum specifications for installation procedures, materials, diagnostic testing and field verification are contained in the Reference Residential Appendix RA3 and Reference Nonresidential Appendix NA2.
<u>DUCT SYSTEM</u>	<p><u>Includes all ducts, duct fittings, plenums, and fans assembled to form a continuous passageway for the distribution of air.</u></p> <p><u>ENTIRELY NEW OR REPLACEMENT DUCT SYSTEMS</u> installed as part of an alteration of a dwelling unit's space conditioning system(s) shall be constructed of at least 75% new duct material and may include reused parts from the dwelling unit's existing duct system (e.g. registers, boots, air handler, coil, plenums, duct material, etc.) but only if the reused parts are accessible and they can be sealed to prevent leakage.</p>
DWELLING UNIT	is a dwelling unit within a multifamily building project or a single family building.
DYNAMIC GLAZING (DG) PRODUCTS	are any fenestration product with the ability to change its performance properties, allowing the occupant to control their environment by tinting (or darkening) a window with the flip of a switch or by raising and lowering a shade positioned between panes of glass.
EA	is Effective Aperture.
EAST-FACING	See <i>Orientation</i> .
ECONOMIZER, AIR	is a ducting arrangement, including dampers, linkages, and an 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.
EDGE OF GLASS	is the portion of fenestration glazing that is within two and one half inches of the spacer.
EER	See <i>Energy Efficiency Ratio</i> .
EFFECTIVE APERTURE (EA)	is a measure of the extent that vertical glazing or skylights are effective for providing daylighting.
EFFICACY, LAMP	is the quotient of rated initial lamp lumens divided by the rated lamp power (watts), without including auxiliaries such as ballasts, transformers, and power supplies.
<u>EFFECTIVE TRIM CAPACITY</u>	<u>is the (continuous) range within 15% of the minimum specific power for a compressor (kW/100acfm).</u>

Term	Definition
<i>EFFICACY, LIGHTING SYSTEM</i>	is the quotient of rated initial lamp lumens measured at 25°C according to IESNA and ANSI Standards, times the ballast factor, divided by the input power (watts) to the ballast or other auxiliary device (e.g. transformer); expressed in lumens per watt.
<i>ELECTRIC HEATING</i>	is an electrically powered heating source, such as electric resistance, heat pumps with no auxiliary heat or with electric auxiliary heat, solar with electric back-up, etc.
<i>ELECTRIC RESISTANCE HEATING</i>	is a heating system that converts electric energy directly into heat energy by passing a current through an electric resistance. Electric resistance heat is inherently less efficient than gas as a heating energy source because it must account for losses associated with generation from depletable fossil fuels and transmission to the building site.
<i>ELECTRICAL/ MECHANICAL ROOM</i>	See <i>Nonresidential Functional Area or Type of Use</i> .
<i>ELECTRONICALLY-COMMUTATED MOTOR</i>	is a brushless DC motor with a permanent magnet rotor that is surrounded by stationary motor windings, and an electronic controller that varies rotor speed and direction by sequentially supplying DC current to the windings.
<i>EMITTANCE, THERMAL</i>	is the ratio of the radiant heat flux emitted by a sample to that emitted by a blackbody radiator at the same temperature.
<i>ENCLOSED SPACE</i>	is space that is substantially surrounded by solid surfaces, including walls, ceilings or roofs, doors, fenestration areas, and floors or ground.
<i>ENERGY BUDGET</i>	is the maximum amount of Time Dependent Valuation (TDV) 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.
<i>ENERGY EFFICIENCY RATIO (EER)</i>	is the ratio of net cooling capacity (in Btu/hr.) to total rate of electrical energy input (in watts), of a cooling system under designated operating conditions, as determined using the applicable test method in the Appliance Efficiency Regulations or §112.
<i>ENERGY EFFICIENCY STANDARDS</i>	See <i>Building Energy Efficiency Standards</i> .
<i>ENERGY FACTOR (EF)</i>	of a water heater is a measure of overall water heater efficiency as determined using the applicable test method in the Appliance Efficiency Regulations.

Term	Definition
ENERGY MANAGEMENT CONTROL SYSTEM (EMCS)	is often a computerized control system designed to regulate the energy consumption of a building by controlling the operation of energy consuming systems, such as the heating, ventilation and air conditioning (HVAC), lighting, and water heating systems. The EMCS is is <u>must</u> also <u>be</u> capable of monitoring environmental and system loads and adjusting HVAC operations in order to optimize energy usage and respond to demand response signals.
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.
ENFORCEMENT 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	See <i>Building Envelope</i> .
EVAPORATIVE COOLER	provides cooling to a building by either direct contact with water (direct evaporative cooler), no direct contact with water (indirect evaporative cooler), or a combination of direct and indirect cooling (indirect/direct evaporative cooler). The credit offered for evaporative coolers depends on building type and climate.
EXCEPTIONAL METHOD	is a method approved by the Commission that analyzes designs, materials, or devices, which cannot be adequately modeled using alternative calculation methods. <u>is a special modeling capability or calculation method for estimating the energy performance of building features that cannot be adequately modeled using the public domain computer programs.</u>
EXECUTIVE DIRECTOR	is the Executive Director of the Commission.
EXERCISE CENTER / GYMNASIUM	See <i>Nonresidential Functional Area or Type of Use</i> .
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.
EXHIBIT	See <i>Nonresidential Functional Area or Type of Use</i> .
EXPOSED THERMAL MASS	is mass that is directly exposed (uncovered) to the conditioned space of the building. Concrete floors that are covered by carpet are not considered exposed thermal mass.

Term	Definition
EXTERIOR DOOR	is a door through an exterior partition that is opaque or has a glazed area that is less than or equal to one-half of the door area. Doors with a glazed area of more than one half of the door area are treated as a fenestration product.
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.
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.
EXTERNALLY ILLUMINATED SIGN	See <i>Sign</i> .
FACTORY ASSEMBLED COOLING TOWERS	are cooling towers constructed from factory-assembled modules either shipped to the site in one piece or put together in the field.

Term	Definition
<u>FENESTRATION</u>	<p><u>Definitions include the following:</u></p> <p><u>AREA is the area of fenestration products (i.e., windows, skylights and glass doors) in exterior openings, including the sash or frame area. The nominal area (from nominal dimensions such as 4.0 X 4.0) or rough opening is also acceptable.</u></p> <p><u>Where the term "glazing area" is used in the standards it is the entire fenestration area, not just the area of glazing, unless stated otherwise.</u></p> <p><u>See Fenestration Product, Glazing Area and Shading.</u></p> <p><u>BAY WINDOW is a combination assembly which is composed of three or more individual windows either joined side by side or installed within opaque assemblies and which projects away from the wall on which it is installed. Center windows, if used are parallel to the wall on which the bay is installed, the end panels or two side windows are angled with respect to the center window(s). Common angles are 30° and 45°, although other angles are sometimes employed.</u></p> <p><u>CURTAIN WALL/STOREFRONT is an external nonbearing wall intended to separate the exterior and interior environments, which may consist entirely (or principally) of a combination of framing materials, glass and glazing, opaque in-fill and other surfacing materials supported by or within a framework.</u></p> <p><u>DUAL-GLAZED GREENHOUSE WINDOWS are a type of dual-glazed fenestration product which adds conditioned volume but not conditioned floor area to a building.</u></p> <p><u>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, garden windows, glass block, and other doors with a glazed area of more than one half of the door area.</u></p> <p><u>FENESTRATION SYSTEM is a collection of fenestration products included in the design of a building. (See "fenestration product")</u></p> <p><u>FIELD-FABRICATED is a fenestration product including a glazed exterior door whose frame is made at the construction site of standard dimensional lumber or other materials that were not previously cut, or otherwise formed with the specific intention of being used to fabricate a fenestration product or exterior door. Field fabricated does not include site-built fenestration with a label certificate or products required to have temporary or permanent labels.</u></p>

Term	Definition
	<u>FIN is a contiguous opaque surface, oriented vertically and projecting outward horizontally from an exterior vertical surface.</u>
	<u>FIN OFFSET is the horizontal distance from the edge of exposed exterior glazing at the jamb of a window to the fin.</u>
	<u>FIN PROJECTION is the horizontal distance, measured outward horizontally from the surface of exposed exterior glazing at the jamb of a window to the outward edge of a fin.</u>
	<u>FIXED is fenestration that is not designed to be opened or closed.</u>
	<u>GLAZED DOOR See DOOR.</u>
	<u>GREENHOUSE/ GARDEN WINDOW is a window unit that consists of a three-dimensional, five-sided structure, with or without an operating sash and creates conditioned volume but no conditioned floor area to a building.</u>
	<u>MANUFACTURED is a fenestration product constructed of materials which are factory cut or otherwise factory formed with the specific intention of being used to fabricate a fenestration product. A manufactured fenestration product is typically factory-assembled before delivery to a job site. However a “knocked-down” or partially assembled product sold as a fenestration product is also a manufactured fenestration product when provided with temporary and permanent labels as described in Section 10-111; otherwise it is a site-built fenestration product when provided with temporary and permanent labels as described in Section 10-111.</u>
	<u>NFRC 100 is the National Fenestration Rating Council document entitled “NFRC 100: Procedure for Determining Fenestration Product U-factors.” (2010; NFRC 100 includes procedures for site fenestration formerly included in a separate document, NFRC 100-SB)</u>
	<u>NFRC 200 is the National Fenestration Rating Council document entitled “NFRC 200: Procedure for Determining Fenestration Product Solar Heat Gain Coefficients and Visible Transmittance at Normal Incidence.” (2010)</u>
	<u>NFRC 202 is the National Fenestration Rating Council document entitled “NFRC 200: Procedure for Determining Fenestration Product Visible Transmittance at Normal Incidence.” (2010)</u>
	<u>NFRC 400 is the National Fenestration Rating Council document entitled “NFRC 400: Procedure for Determining Fenestration Product Air Leakage.” (10)</u>

Term	Definition
	<p><u>OPERABLE</u> is fenestration that is designed to be opened or closed.</p>
	<p><u>OPERABLE SHADING DEVICE</u> 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.</p>
	<p><u>OVERHANG</u> is a contiguous opaque surface, oriented horizontally and projecting outward horizontally from an exterior vertical surface.</p>
	<p><u>OVERHANG OFFSET</u> is the vertical distance from the edge of exposed exterior glazing at the head of a window to the overhang.</p>
	<p><u>OVERHANG PROJECTION</u> is the horizontal distance, measured outward horizontally from the surface of exposed exterior glazing at the head of a window to the outward edge of an overhang.</p>
	<p><u>SITE-BUILT</u> is fenestration designed to be field-glazed or field assembled units using specific factory cut or otherwise factory formed framing and glazing units. Examples of site-built fenestration include storefront systems, curtain walls, and atrium roof systems.</p>
	<p><u>SOLAR HEAT GAIN COEFFICIENT (SHGC)</u> is the ratio of the solar heat gain entering the space through the fenestration area to the incident solar radiation. Solar heat gain includes directly transmitted solar heat and absorbed solar radiation, which is then reradiated, conducted, or convected into the space.</p>
	<p><u>SOLAR HEAT GAIN COEFFICIENT, CENTER OF GLAZING (SHGC_c)</u> is the SHGC for the center of glazing area.</p>
	<p><u>SOLAR HEAT GAIN COEFFICIENT, TOTAL FENESTRATION PRODUCT (SHGC or SHGCT)</u> is the SHGC for the total fenestration product.</p>
	<p><u>SPANDREL</u> is opaque glazing material most often used to conceal building elements between floors of a building so they cannot be seen from the exterior, also known as “opaque in-fill systems”.</p>
	<p><u>U-FACTOR, FENESTRATION</u> is the overall coefficient of thermal transmittance of a construction assembly, in Btu/(hr x ft² x °F), including air film resistance at both surfaces.</p>
	<p><u>U-FACTOR, CENTER OF GLAZING (U-FACTOR_c)</u> is the U-Factor for the center of glazing area.</p>

Term	Definition
	<p><u>U-FACTOR, TOTAL FENESTRATION PRODUCT (U-FACTOR or U-FACTORt)</u> is the U-Factor for the total fenestration product.</p> <p><u>VISIBLE TRANSMITTANCE (VT)</u> is the ratio (expressed as a decimal) of visible light that is transmitted through a glazing fenestration to the light that strikes the material fenestration. as For products with the scope of NFRC 200, visible transmittance shall be calculated in NFRC 200. For products not within the scope of NFRC 200 (diffusing and projecting glazing's), visible transmittance shall be the solar photometric transmittance of the glazing material(s) determined in accordance with NFRC 202 or ASTM E972.</p> <p><u>VISIBLE TRANSMITTANCE, CENTER OF GLAZING (VT_C)</u> the VT for the center of glazing area.</p> <p><u>VISIBLE TRANSMITTANCE, TOTAL FENESTRATION PRODUCT (VT or VT_t)</u> is the VT for the total fenestration product.</p>
<i>FENESTRATION AREA</i>	<p>is the area of fenestration products (i.e., windows, skylights and glass doors) in exterior openings, including the sash or frame area. The nominal area (from nominal dimensions such as 4.0 X 4.0) or rough opening is also acceptable.</p> <p>Where the term "glazing area" is used in the standards it is the entire fenestration area, not just the area of glazing, unless stated otherwise.</p> <p>See <i>Fenestration Product, Glazing Area and Shading</i>.</p>
<i>FENESTRATION PRODUCT</i>	<p>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, garden windows, glass block and other doors with a glazed area of more than one half of the door area.</p>
<i>FENESTRATION PRODUCT, FIELD-FABRICATED</i>	<p>is a fenestration product, including a glazed exterior door, whose frame is made at the construction site of standard dimensional lumber or other materials that were not previously cut, or otherwise formed with the specific intention of being used to fabricate a fenestration product or exterior door. Field fabricated does not include site-built fenestration with a certificate label or products required to have temporary or permanent labels.</p>

Term	Definition
<i>FENESTRATION PRODUCT, MANUFACTURED</i>	is a fenestration product constructed of materials which are factory cut or otherwise factory formed with the specific intention of being used to construct a fenestration product. A manufactured fenestration product is typically factory-assembled before delivery to a job site. However a “knocked-down” or partially assembled product sold as a fenestration product is also a manufactured fenestration product when provided with temporary and permanent labels as described in §10-111 of Title 24 Part 1; otherwise it is a site-built fenestration product when provided with temporary and permanent labels as described in §10-111.
<i>FENESTRATION PRODUCT, SITE-BUILT</i>	is fenestration designed to be field-glazed or field assembled units using specific factory cut or otherwise factory formed framing and glazing units. Examples of site-built fenestration include storefront systems, curtain walls, and atrium roof systems.
<i>FENESTRATION SYSTEM</i>	is a collection of fenestration products included in the design of a building. (See “fenestration product”)
<i>FENESTRATION, BAY WINDOW</i>	is a combination assembly which is composed of three or more individual windows either joined side by side or installed within opaque assemblies and which projects away from the wall on which it is installed. Center windows, if used are parallel to the wall on which the bay is installed. The two side windows are angled with respect to the center window(s). Common angles are 30° and 45°, although other angles are sometimes employed.
<i>FENESTRATION, CURTAIN WALL</i>	is an external, nonbearing wall intended to separate the exterior and interior environments, which may consist entirely (or principally) of a combination of framing materials, glass and glazing, opaque in-fill and other surfacing materials supported by or within a framework.
<i>FENESTRATION, GARDEN WINDOW</i>	a window unit that consists of a three-dimensional, five-sided structure, with or without an operating sash, also known as greenhouse window.
<i>FENESTRATION, SPANDREL</i>	is opaque glazing material most often used to conceal building elements between floors of a building so that they cannot be seen from the exterior, also known as “opaque in-fill systems”.
<i>FIELD ERECTED COOLING TOWERS</i>	are cooling towers which are custom designed for a specific application and which can not be delivered to a project site in the form of factory assembled modules due to their size, configuration, or materials of construction.

Term	Definition
<u>FIELD TECHNICIAN</u>	<u>is responsible for performing the acceptance test procedures and documenting the results of the acceptance tests on the Certificate of Acceptance document. The Field Technician shall sign the Certificate of Acceptance to certify that the information provided on the Certificate of Acceptance is true and correct.</u>
FIELD-FABRICATED FENESTRATION PRODUCT OR EXTERIOR DOOR	is a fenestration product or exterior door whose frame is made at the construction site of standard dimensional lumber or other materials that were not previously cut, or otherwise formed with the specific intention of being used to fabricate a fenestration product or exterior door. Field fabricated does not include site-built fenestration with a label certificate or products required to have temporary or permanent labels.
FINANCIAL TRANSACTION	See <i>Nonresidential Functional Area or Type of Use</i> .
FIREPLACE	is a hearth and fire chamber or similar prepared place in which a fire may be made and which is built in conjunction with a flue or chimney, including but not limited to factory-built fireplaces, masonry fireplaces, and masonry heaters as further clarified in the CBC.
FLOOR AREA	is the floor area (in square feet) of enclosed conditioned or unconditioned space on all floors of a building, as measured at the floor level of the exterior surfaces of exterior walls enclosing the conditioned or unconditioned space.
FLOOR/SOFFIT TYPE	is a type of floor/soffit assembly having a specific heat capacity, framing type, and U-factor.
<u>FLUID COOLER</u>	<u>is a fan-powered heat rejection device that includes a water circuit connected by a closed circulation loop to a water-cooled refrigerant condenser, and may be either evaporative-cooled or air-cooled.</u>
FLUX	is the rate of energy flow per unit area.
FOOD PREPARATION EQUIPMENT	is cooking equipment intended for commercial use, including coffee machines, espresso coffee makers, conductive cookers, food warmers including heated food servers, fryers, griddles, nut warmers, ovens, popcorn makers, steam kettles, ranges, and cooking appliances for use in commercial kitchens, restaurants, or other business establishments where food is dispensed.
FOSSIL FUELS	are fuels which are derived from natural gas, coal, oil and liquefied petroleum products. These are generally nonrenewable resources, although natural gas may also be produced by other means, such as biomass conversion.
FRAMED PARTITION OR ASSEMBLY	is a partition or assembly constructed using separate structural members spaced not more than 32 inches on center.

Term	Definition
FRAMING EFFECTS	is the effect on the overall U-factor due to the type and amount of framing in walls, roofs/ceilings and floors . For compliance, fixed values for wood framing percentages are assumed when calculating U-factors.
FRAMING PERCENTAGE	is the fraction of the surface of a partition that is framing as compared to that portion which is cavity.
<u>FREEZER</u>	<u>is a space designed to maintain less than 28°F and space designed to be convertible between cooler and freezer operation.</u>
FRONT	is the primary entry side of the building (front facade) used as a reference in defining the orientation of the building or unit plan. The orientation of the front facade may not always be the same as that for the front door itself.
GAP WIDTH	is the distance between glazings - <u>lites</u> in multi-glazed systems. This is typically measured from inside surface to inside surface, though some manufacturers may report "overall" IG width, which is measured from outside surface to outside surface.
GAS COOLING EQUIPMENT	is cooling equipment that produces chilled water or cold air using natural gas or liquefied petroleum gas as the primary energy source.
GAS HEATING SYSTEM	is a natural gas or liquefied petroleum gas heating system.
GAS INFILLS	are air, argon, krypton, CO ₂ , SF ₆ , or a mixture of these gasses between the panes of glass in insulated glass units.
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 COMMERCIAL AND INDUSTRIAL WORK	See <i>Nonresidential Functional Area or Type of Use</i> .
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.
GEOHERMAL HEAT PUMP	See <i>Ground Source Heat Pump</i> .
<u>GLAZED DOOR</u>	<u>See DOOR</u>
GLAZING	See <i>Fenestration Product</i> .
GLAZING AREA	See <i>Fenestration Area</i> .
<u>GLOBAL WARMING POTENTIAL (GWP)</u>	<u>is the radiative forcing impact of one mass-based unit of a given greenhouse gas relative to an equivalent unit of carbon dioxide over a given period of time.</u>

Term	Definition
<u>GLOBAL WARMING POTENTIAL VALUE (GWP VALUE)</u>	is the 100-yr GWP value first published by the Intergovernmental Panel on Climate Change (IPCC) in its Second Assessment Report (SAR) (IPCC, 1995; or if a 100-yr GWP value was not specified in the IPCC SAR, it means the GWP value published by the IPCC in its Fourth Assessment A-3 Report (AR4) (IPCC, 2007); or if a 100-yr GWP value was not specified in the IPCC AR4, then the GWP value will be determined by the Commission based on data, studies and/or good engineering or scientific judgment. Both the 1995 IPCC SAR values and the 2007 IPCC AR4 values are published in table 2.14 of the 2007 IPCC AR4. The SAR GWP values are found in column "SAR (100-yr)" of Table 2.14.; the AR4 GWP values are found in column "100 yr" of Table 2.14."
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.
GREENHOUSE WINDOW	is a type of fenestration product which adds conditioned volume but no conditioned floor area to a building.
GRILLES	See <i>Dividers</i> .
GROCERY SALES	See <i>Nonresidential Functional Area or Type of Use</i> .
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.
GROUND FLOOR AREA	is defined as the slab-on-grade area of a slab-on-grade building and the conditioned footprint area of a raised floor building (for compliance with the low-rise residential standards).
GROUND SOURCE HEAT PUMP	is a heat pump that uses the earth as a source of energy for heating and a sink for energy when cooling. Some systems pump water from an aquifer in the ground and return the water to the ground after transferring heat from or to the water. A few systems use refrigerant directly in a loop of piping buried in the ground. Those heat pumps that use either a water loop or pump water from an aquifer have efficiency test methods that are accepted by the Energy Commission. These efficiency values are certified to the Energy Commission by the manufacturer and are expressed in terms of heating Coefficient of Performance (COP) and cooling Energy Efficiency Ratio (EER).

Term	Definition
GU-24	is the designation of a lamp holder and socket configuration, based on a coding system by the International Energy Consortium, where “G” indicates the broad type of two or more projecting contacts, such as pins or posts, “U” distinguishes between lamp and holder designs of similar type but that are not interchangeable due to electrical or mechanical requirements, and “24” indicates 24 millimeters center to center spacing of the electrical contact posts.
<u>HABITABLE SPACE</u>	<u>is building space intended for continual human occupancy; such space generally includes areas used for living, sleeping, dining, and cooking but does not generally include bathrooms, toilets, hallways, storage areas, closets, or utility rooms.</u>
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.
HARD COAT	is a low emissivity metallic coating applied to the glass, which will be installed in a fenestration product, through a pyrolytic process (at or near the melting point of the glass so that it bonds with the surface layer of glass). Hard coatings are less susceptible to oxidation and scratching as compared to soft coats. Hard coatings generally do not have as low emissivity as soft coats.
HARDSCAPE	See <i>Outdoor Lighting</i> .
HEAT CAPACITY (HC)	is the amount of heat necessary to raise the temperature of all the components of a unit area in an assembly by 1°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 °F.
HEAT PUMP	is a device that is capable of heating by refrigeration, and that may include a capability for cooling.
HEATED SLAB FLOOR	is a concrete slab floor or a lightweight concrete topping slab laid over a raised floor, with embedded space heating hot water pipes. The heating system using the heated slab floor is sometimes referred to as radiant slab floors or radiant heating.
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 central air-conditioning heat pump (in Btu) 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.
HERS PROVIDER	See <i>Home Energy Rating System Provider</i> .

Term	Definition
HERS PROVIDER DATA REGISTRY	is a residential data registry maintained by an approved HERS provider. means the database maintained by the HERS provider that contains the records of the HERS rater's field verification and diagnostic testing results, including dwelling unit identification information, test/certification identification information, and builder identification information.
HERS RATER	See <i>Home Energy Rating System Rater</i> .
HI	is the Hydronics Institute of the Gas Appliance Manufacturers Association (GAMA).
HI HTG BOILER STANDARD	is the Hydronics Institute document entitled "Testing and Rating Standard for Rating Boilers," 1989.
HIGH BAY	See <i>Nonresidential Functional Area or Type of Use, General commercial and industrial work</i> .
HIGH-RISE RESIDENTIAL BUILDING	is a building, other than a hotel/motel, of Occupancy Group R, Division 1 with four or more habitable stories.
HOME ENERGY RATING SYSTEM (HERS) PROVIDER	is an organization that approved by the Commission has approved to administer a home energy rating system program, certify raters and maintain quality control over field verification and diagnostic testing required for compliance with the Energy Efficiency Standards.
HOME ENERGY RATING SYSTEM RATER	is a person certified by a Commission approved HERS Provider to perform the field verification and diagnostic testing required for demonstrating compliance with the Energy Efficiency Standards.

Term	Definition
HOOD	<p>is a device designed to capture and contain cooking effluent including, grease, smoke, steam, heat, and vapor until it is exhausted through a duct or recirculating system. Hoods are categorized as Type 1 or Type 2:</p> <p>TYPE I HOOD is a hood used for collecting and removing convective heat, grease particulate, condensable vapor, and smoke. It includes listed grease filters, baffles, or extractors for removing the grease and a fire-suppression system. Type I hoods are installed over cooking appliances, such as ranges, fryers, griddles, broilers, and ovens, that produce smoke or grease-laden vapors. For Type I hoods, the following types of hoods are commonly available:</p> <p>WALL-MOUNTED CANOPY HOOD is mounted against a wall above a single appliance or a line of appliances, or it may be free-standing with a vertical back panel extending from the rear of the appliance(s) to the hood. It typically extends beyond the front and sides of the appliance(s) on all open sides. The wall acts as a back panel, forcing replacement air to be drawn across the front and/or side(s) of the cooking appliance, thus increasing the effectiveness of the hood to capture and contain effluent generated by the cooking operations.</p> <p>SINGLE ISLAND CANOPY HOOD is placed over a single appliance or line of appliances. It is open on all sides and overhangs the front, rear, and sides of the appliance(s). A single island canopy is more susceptible to cross-drafts and requires a greater exhaust airflow than an equivalent sized wall-mounted canopy to capture and contain effluent generated by the cooking operations.</p> <p>DOUBLE ISLAND CANOPY HOOD is placed over back-to-back appliances or lines of appliances. It is open on all sides and overhangs the front and the sides of the appliance(s). It may have a wall panel between the backs of the appliances.</p> <p>BACKSHELF or PROXIMITY HOOD is also referred to as a low-proximity hood or as a sidewall hood where wall mounted. Its front lower lip is low over the appliance(s) and is typically set back from the front of the appliance(s). It is always closed to the rear of the appliances by a panel where freestanding or by a panel or wall when wall mounted, and its height above the cooking surface varies. This style of hood can be constructed with partial end panels to increase its effectiveness in capturing the effluent generated by the cooking operations.</p>

Term	Definition
	<p>EYEBROW HOOD is mounted directly to the face or top of an appliance above the opening(s) or door(s) from which effluent is emitted, overhanging the front of the opening(s) to capture the effluent.</p>
	<p>PASS_OVER HOOD is a backshelf hood constructed and installed low enough to allow food to be passed over the top.</p>
	<p>TYPE II HOOD is a hood that collects and removes steam, heat, and products of combustion where grease or smoke is not present. It may or may not have grease filters or baffles and typically does not have a fire-suppression system. They can be used where the cooking operation from each appliance underneath the hood does not produce grease in excess of 5 mg/m when measured at 500 cfm exhaust airflow.</p>
HORIZONTAL GLAZING	See <i>Skylight</i> .
HOTEL AND MOTEL GUEST ROOM	is a guest room of a Hotel/Motel.
HOTEL FUNCTION AREA	See <i>Nonresidential Functional Area or Type of Use</i> .
HOTEL LOBBY	See <i>Nonresidential Functional Area or Type of Use, Lobby, Hotel</i> .
HOTEL/MOTEL	<p>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 heating, ventilation, and air-conditioning 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.</p>
HSPF	See <i>Heating Seasonal Performance Factor</i> .
HVAC SYSTEM	See <i>Space-conditioning System</i> .
HYDRONIC COOLING SYSTEM	<p>is any cooling system which uses water or a water solution as a source of cooling or heat rejection, including chilled water systems (both air and water-cooled) as well as water-cooled or evaporatively cooled direct expansion systems, such as water source (water-to-air) heat pumps.</p>

Term	Definition
HYDRONIC SPACE HEATING SYSTEM	is a system that uses water-heating equipment, such as a storage tank water heater or a boiler, to provide space heating. Hydronic space heating systems include both radiant floor systems and convective or fan coil systems. See <i>Combined Hydronic Space/Water Heating System</i> .
IESNA-IES HB	See IESNA-IES <i>Lighting Handbook</i> .
IESNA-IES LIGHTING HANDBOOK	is the Illuminating Engineering Society National Association document entitled "The IESNA-IES Lighting Handbook: Reference and Applications, Ninth Tenth Edition" (2010 2009).
IG UNIT	See <i>Insulating Glass Unit</i> .
ILLUMINATED FACE	See <i>Sign</i> .
INDEPENDENT IDENTITY	is having no financial interest in, and not advocating or recommending the use of any product or service as a means of gaining increased business with, firms or persons specified in Section 1673(i) of the California Home Energy Rating System Program regulations (California Code of Regulations, Title 20, Division 2, Chapter 4, Article 8). (Financial Interest is an ownership interest, debt agreement, or employer/employee relationship. Financial interest does not include ownership of less than 5 percent of the outstanding equity securities of a publicly traded corporation.) NOTE: The definitions of "independent entity" and "financial interest," together with Title 20, Section 1673(i), prohibit conflicts of interest between HERS Providers and HERS Raters, or between Providers/Raters and builders/subcontractors.
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 a thermal transmittance area product (UA) to directly conditioned space exceeding that to the outdoors or to unconditioned space and does not have fixed vents or openings to the outdoors or to unconditioned space, or (b) is a space through which air from directly conditioned spaces is transferred at a rate exceeding three air changes per hour.
INDUSTRIAL AND COMMERCIAL STORAGE BUILDING	See <i>Nonresidential Functional Area or Type of Use</i> .
INDUSTRIAL EQUIPMENT	is manufactured equipment used in industrial processes.
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.

Term	Definition
INFILTRATION CONTROLS	are measures taken to control the infiltration of air. (Mandatory Infiltration control measures include weather-stripping, caulking, and sealing in and around all exterior joints and openings.)
INSTALLATION CERTIFICATE <u>OF INSTALLATION</u> (CF-6R)	is a document with information required by the Commission that is prepared by the builder or installer verifying that the measure was installed to meet the requirements of the Standards.
INSTALLER	means the builder's subcontractor or the person installing the equipment.
INSULATING GLASS UNIT	is a self-contained unit, including the glazings (<u>lites or panes of glass?</u>), spacer(s), films (if any), gas infills, and edge caulking, that is installed in fenestration products. It does not include the frame.
INSULATION	<p>Insulation is a material that limits heat transfer. Insulating material of the types and forms listed in Section 110.8(a) may be installed only if the manufacturer has certified that the insulation complies with the Standards for Insulating Material, Title 24, Part 12, Chapter 12-13 of the California Code of Regulations.</p> <p>(Insulation must be placed within or contiguous with a wall, ceiling or floor, or over the surface of any appliance or its intake or outtake mechanism for the purpose of reducing heat transfer or reducing adverse temperature fluctuations of the building, room or appliance. Insulation may be installed in wall, ceiling/roof and raised floor assemblies and at the edge of a slab-on-grade. Movable insulation is designed to cover windows and other glazed openings part of the time to reduce heat loss and heat gain.)</p>
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 §112.
INTERIOR PARTITION	is an interior wall or floor/ceiling that separates one area of conditioned space from another within the building envelope.
INTERNALLY ILLUMINATED SIGN	See <i>Sign</i> .
IPLV	See <i>Integrated Part Load Value</i> .
ISO 13256-1	is the International Organization for Standardization document entitled "Water-source heat pumps -- Testing and rating for performance -- Part 1: Water-to-air and brine-to-air heat pumps," 1998.

Term	Definition
ISO/IEC 17011	is the International Organization for Standardization and the International Electrotechnical Commission document entitled "Conformity assessment – General requirements for accreditation bodies accrediting conformity assessment bodies." (EN ISO/IEC 17011:2004)
ISO/IEC 17020	is the International Organization for Standardization and the International Electrotechnical Commission document entitled "General criteria for the operation of various types of bodies performing inspection." (EN ISO/IEC 17020:2004)
ISO/IEC 17025	is the International Organization for Standardization and the International Electrotechnical Commission document entitled "General requirements for the competence of testing and calibration laboratories." (EN ISO/IEC 17025:2005)
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.
KITCHEN	See <i>Residential Space Type</i> .
KITCHEN/FOOD PREPARATION	See <i>Nonresidential Functional Area or Type of Use</i> .
KNEE WALL	is a sidewall separating conditioned space from attic space under a pitched roof. Knee walls should be insulated as an exterior wall as specified by the chosen method of compliance.
LANDSCAPE LIGHTING	See <i>Outdoor Lighting</i> .
<u>LANGELIER SATURATION INDEX</u>	<u>The Langelier Saturation Index (LSI) is expressed as the difference between the actual system pH and the saturation pH.</u> <u>LSI indicates whether water will precipitate, dissolve, or be in equilibrium with calcium carbonate, and is a function of hardness, alkalinity, conductivity, pH and temperature.</u>
LANTERN	See <i>Outdoor Lighting</i> .
<u>LARGEST NET CAPACITY INCREMENT</u>	<u>is the largest increase in capacity when switching between combinations of base compressors that is expected to occur under the system control scheme.</u>
LAUNDRY	See <i>Nonresidential Functional Area or Type of Use</i> .
LEFT SIDE	is the left side of the building as one faces the front facade from the outside. This designation is used on the Certificate of Compliance and other compliance documentation.
LIBRARY	See <i>Nonresidential Functional Area or Type of Use</i> .
LIGHT-EMITTING DIODE (LED)	is a pn junction semiconductor device that emits incoherent optical radiation when biased in the forward direction. The acronym "LED" typically refers to an LED component, LED device, or LED package. Hybrid LED Luminaire is a complete lighting unit

Term	Definition
	<p>consisting of a light source and driver together with parts to distribute light, to position and protect the light source, and to connect the light source to a branch circuit. The light sources in the Hybrid LED Luminaire contain both LED Source Systems, or LED Lamps, as well as other type of light sources such as incandescent or fluorescent lamps. The Hybrid LED Luminaire is intended to be connected directly to a branch circuit.</p> <p>LED Array is an assembly of LED components, LED devices or LED packages on a printed circuit board or substrate, possibly with optical elements and additional thermal, mechanical, and electrical (LED Control Circuitry) interfaces that are connected to the load side of LED Driver (Power Source). LED Array does not contain an LED Driver (Power Source) and is not connected directly to the branch circuit.</p> <p>LED Component (or LED Device, or LED Package) is a semiconductor die that contains wire bond connections, possibly with an optical element, or a thermal, mechanical, or electrical interface. LED Component, LED Device, or LED Package does not contain an LED Driver (Power Source) and is not connected directly to the branch circuit.</p> <p>LED Control Circuitry is electronic components located between the Power Source (LED Driver) and the LED Component, or LED Device, or LED Package designed to limit voltage and current, to dim, to switch or otherwise control the electrical energy to the LED. The circuitry does not include a Power Source.</p> <p>LED Driver is a power source with integral LED control circuitry designed to meet the specific requirements of an LED lamp, an LED array, or an LED Module. Typically LED Driver (Power Source) contains the LED Control Circuitry.</p> <p>LED Lamp is an LED Component, LED Device, or LED Package and other optical, thermal, mechanical and electrical (LED Control Circuitry) components with an integrated LED Driver (Power Source) and a standardized base that is designed to connect to the branch circuit via a standardized base, lamp-holder, or socket.</p> <p>In North America, “a standardized base” refers to an ANSI standard base. In the U.S. “branch circuit” is used to describe the “mains voltage” in IEC documents.</p> <p>Note: Non-integrated type of LED Lamp should not be defined, it is a LED Module.</p> <p>LED Light Engine with Integral Heat Sink (or LED Light Source System) is a subsystem of an LED Luminaire that includes one or more LED Components, LED Devices or LED Packages, an LED Array, or LED Module; an LED Driver (Power Source);</p>

Term	Definition
	<p>electrical and mechanical interfaces; and an integral heat sink to provide thermal dissipation. An LED Source System may be designed to accept additional components that provide aesthetic, optical, and environmental control (other than thermal dissipation). An LED Source System with standardized base is an LED Lamp.</p> <p>LED Luminaire is a complete LED lighting unit consisting of a light source and driver together with parts to distribute light, to position and protect the light source, and to connect the light source to a branch circuit. The light source itself may be an LED Component, LED Package or LED Device, LED Array, an LED Module, an LED Source System, or an LED Lamp. The LED Luminaire is intended to be connected directly to a branch circuit.</p> <p>LED Module is a component part of an LED Source System that includes one or more LED Components, LED Devices or LED Packages, possibly with optical elements and additional thermal, mechanical, and electrical (LED Control Circuitry) interfaces that are connected to the load side of LED Drive (Power Source). The LED Module does not contain a power source. An LED Array is equivalent to an LED Module.</p>

Term	Definition
<u>LIGHTING</u>	<p><u>Definitions include the following:</u></p> <p><u>Accent Light is directional lighting designed to highlight or spotlight objects. It can be recessed, surface mounted, or mounted to a pendant, stem, or track.</u></p> <p><u>Chandelier is a ceiling-mounted, close-to-ceiling, or suspended decorative luminaire that uses glass, crystal, ornamental metals, or other decorative material and that typically is used in hotel/motels, restaurants, or churches as a significant element in the interior architecture.</u></p> <p><u>Compact Fluorescent Lamp is a fluorescent lamp less than 9 inches long, with a small diameter glass tube (T5 or less) that is folded, bent, or bridged to create a long discharge path in a small volume. The lamp designs generally include an amalgam and a cold chamber, or a cold spot, to control the mercury vapor pressure and light output.</u></p> <p><u>Decorative Lighting is lighting used in a decorative manner that does not serve as display lighting or general lighting.</u></p> <p><u>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.</u></p> <p><u>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.</u></p> <p><u>GU-24 is the designation of a lamp holder and socket configuration, based on a coding system by the International Energy Consortium, where "G" indicates the broad type of two or more projecting contacts, such as pins or posts, "U" distinguishes between lamp and holder designs of similar type but that are not interchangeable due to electrical or mechanical requirements, and "24" indicates 24 millimeters center to center spacing of the electrical contact posts.</u></p> <p><u>Lantern is an outdoor luminaire that uses an electric lamp to replicate a pre-electric lantern, which used a flame to generate light.</u></p> <p><u>Light Emitting Diode (LED) definitions used in Title 24 Part 6 are in section 6.8 of ANSI/IES RP-16-10.</u></p>

Term	Definition
	<p><u>Luminaire</u> is a complete lighting unit consisting of a lamp(s) and the parts designed to distribute the light, to position and protect the lamp(s), and to connect the lamp(s) to the power supply.</p>
	<p><u>Lumen Maintenance</u> is a lighting control strategy to provide a precise constant level of lighting from a lighting system regardless of the age of the lamps or the maintenance of the luminaires.</p>
	<p><u>Marquee lighting</u> is a permanent lighting system consisting of one or more rows of many small lights, including light emitting diodes (LEDs), or fiber optic lighting, attached to a canopy.</p>
	<p><u>Ornamental lighting</u> for compliance with Title 24, Part 6 is the following:</p>
	<p><i><u>Luminaires installed outdoor which are rated for 100 watts or less that are post-top luminaires, lanterns, pendant luminaires, chandeliers, and marquee lighting.</u></i></p>
	<p><i><u>Luminaires installed indoor that are chandeliers, sconces, lanterns, neon and cold cathode, light emitting diodes, theatrical projectors, moving lights, and light color panels when used in a decorative manner that does not serve as display lighting or general lighting.</u></i></p>
	<p><u>Pendant</u> is a mounting method in which the luminaire is suspended from above.</p>
	<p><u>Permanently Installed lighting</u> includes all luminaires attached to the inside or outside of a building or site, including track and flexible lighting system; lighting attached to walls, ceilings, columns, inside or outside of permanently installed cabinets, internally illuminated case work, mounted on poles, in trees, or in the ground; attached to ceiling fans and integral to exhaust fans that are other than exhaust hoods for cooking equipment. Permanently installed luminaires may have either plug-in or hardwired connections for electric power. Permanently installed lighting does not include portable lighting or lighting that is installed by the manufacturer in refrigerators, stoves, microwave ovens, exhaust hoods for cooking equipment, refrigerated cases, vending machines, food preparation equipment, and scientific and industrial equipment.</p>
	<p><u>Portable Lighting</u> is lighting with plug-in connections for electric power that is table and freestanding floor lamps, attached to modular furniture, workstation task lights, lights attached to workstation panels, movable displays, and other equipment that is not permanently installed lighting.</p>

Term	Definition
	<p><u>Post top luminaire</u> is an outdoor luminaire that is mounted directly on top of a lamp-post.</p>
	<p><u>Precision Lighting</u> is task lighting for general commercial or industrial work of low contrast, fine detail, or fast moving objects.</p>
	<p><u>Task Lighting</u> is lighting that is designed specifically to illuminate a task location, and that is generally confined to the task location.</p>
	<p><u>Temporary Lighting</u> is a lighting installation with plug-in connections that does not persist beyond 60 consecutive days or more than 120 days per year.</p>
	<p><u>Track Lighting</u> is a system that includes small luminaires and a track, rails, or cables that are designed to provide both mounting and deliver electric power. Track is generally made of linear extruded aluminum containing copper wires, or may be a low-voltage cable system, to form a continuous electrical raceway. Some varieties can be joined, or cut, and others set into a variety of patterns with connectors. Track is available in line-voltage or low-voltage</p> <p><i><u>Line-Voltage Track is equipped with luminaires that use line-voltage lamps or are equipped with integral transformers at each luminaire.</u></i></p> <p><i><u>Low-Voltage Track is equipped with remote transformers for use with low-voltage equipment along the entire length of track</u></i></p> <p><i><u>Track Mounted Luminaires are small luminaires designed to be attached at any point along a track lighting system. Track mounted luminaires may be line-voltage or low-voltage.</u></i></p>
	<p><u>Tuning</u> is the ability to set maximum light levels at a lower level than full lighting power, to which the space occupants are generally not aware.</p>

Term

Definition

LIGHTING CONTROLS

Include the following:

Astronomical Time-Switch Control is a lighting control that controls lighting based on the time of day or based on astronomical events such as sunset and sunrise, accounting for geographic location and day of the year.

Automatic Daylight Control is a lighting control that automatically adjusts lighting levels in response to available daylight. This control uses one or more photosensors to detect changes in daylight illumination and then changes the electric lighting level in response to the daylight changes.

Term	Definition
	<p><u>Automatic Multi-Level Daylight Control</u> is a lighting control that automatically adjusts lighting levels in multiple steps or continuous dimming in response to available daylight. This control uses one or more photosensors to detect changes in daylight illumination and then changes the electric lighting level in response to the daylight changes.</p> <p><u>Automatic Time Switch Control</u> is a lighting control that controls lighting based on the time of day.</p> <p><u>Countdown Timer Switch</u> is a control that turns lights or other loads ON when activated using one or more selectable count-down time periods and then automatically turns lights or other loads OFF when the selected time period had elapsed.</p> <p><u>Daylighting Control</u> is an Automatic Daylighting Control, or a Photo Control.</p> <p><u>Dimmer</u> is a lighting control that varies the current through an electric light in order to control the level of illumination and the energy use.</p> <p><u>Dimmer, Full-Range</u> means varying the light output of lamps over a continuous range from full light output to minimum light output.</p> <p><u>Dimmer, Stepped</u> means varying the light output of lamps in one or more predetermined discrete steps between full light output and OFF.</p> <p><u>Energy Management Control System (EMCS)</u> see ENERGY MANAGEMENT CONTROL SYSTEM</p> <p><u>Lighting Control, Self Contained</u> is a unitary lighting control module where no additional components are required for a fully functional lighting control.</p> <p><u>Lighting Control System</u> is a lighting control where two or more components are required to be installed in the field to provide all of the functionality required to make up a fully functional and compliant lighting control.</p> <p><u>Multi-Level Astronomical Time Switch</u> is an Astronomical Time Switch Control that reduces lighting power in multiple steps.</p> <p><u>Multi-Level Lighting Control</u> is a lighting control that reduces lighting power in multiple steps.</p> <p><u>Multiscene Programmable Control</u> is a lighting control that allows for two or more pre-defined lighting settings, in addition to all-OFF, for two or more groups of luminaires to suit multiple activities in the space, and allows convenient recall of those settings.</p>

Term	Definition
	<p><u>Occupant Sensing Controls</u> are lighting controls which automatically control light as described below, and allow for complete manual operation, and includes the following types:</p> <p><u>Occupant Sensor</u> is used indoors and automatically turns lights OFF when an area is vacated, and automatically turns the lights ON when the area is occupied.</p> <p><u>Motion Sensor</u> is used outdoors and automatically turns lights OFF when an area is vacated, and automatically turns the lights ON when the area is occupied.</p> <p><u>Partial-ON Occupant/Motion/Vacancy Sensor</u> automatically turns lights OFF when an area is vacated, capable of automatically turning ON part of the lighting load and manually turning ON part of the lighting load when an area is occupied.</p> <p><u>Partial-OFF Occupant/Motion/Vacancy Sensor</u> automatically turns OFF part of the lighting load when an area is vacated, and capable of automatically turning ON the lighting load when an area is occupied.</p> <p><u>Vacancy Sensor</u> automatically turns lights OFF when an area is vacated and requires lighting loads to be manually turned ON.</p> <p><u>Part-Night Outdoor Lighting Control</u> is a time or occupancy-based lighting control device or system that reduces or turns off the lighting power to an outdoor luminaire for a portion of the night. An example of a part-night outdoor lighting control would be to dim the lamp halfway through the night, and turn the lamp back up to full output sometime before dawn if needed to address morning commute requirements. Another example may turn the lamp completely off half way through the night.</p> <p><u>Photo Control</u> is an Automatic Daylighting Control that automatically turns lights ON and OFF, or automatically adjusts lighting levels, in response to the amount of daylight that is available. A Photo Control may also be one component of a field assembled lighting system, the component having the capability to provide a signal proportional to the amount of daylight to a Lighting Control System for the purpose of continuously dimming the electric lights.</p> <p><u>Time Switch Control</u> is an Automatic Time Switch Control, Astronomical Time Switch Control, or Multi-Level Astronomical Time Switch Control.</p>

Term	Definition
	<p><u>Track Lighting Integral Current Limiter</u> is a lighting control device in which a current limiter is integral to the end-feed housing of a manufactured line-voltage track lighting system, where the end-feed housing and connecting track are manufactured by the same company to be exclusively used together.</p> <p><u>Track Lighting Supplementary Overcurrent Protection Panel</u> is a listed electrical panel that provides limited overcurrent protection for use only with line voltage track lighting. This limited protection is in addition to the protection provided in the required branch circuit overcurrent protective device, and cannot be used as a substitute for required branch-circuit overcurrent devices, or in place of the required branch-circuit protection.</p>
LIGHTING ZONE	See <i>Outdoor Lighting</i> .
LIQUID LINE	is the refrigerant line that leads from the condenser to the evaporator in a split system air conditioner or heat pump. The refrigerant in this line is in a liquid state and is at an elevated temperature. This line should not be insulated.
LISTED	is equipment, materials, or services included in a list published by an organization that is recognized to have the authority to evaluate and test the equipment, material or services. The organization performs periodic inspection and evaluation to ensure that the listed equipments, material, or services meet identified standards or has been tested and found suitable for a specified purpose. The recognized organizations include but are not limited to the Underwriters Laboratories (UL).
LOCKER/DRESSING ROOM	See <i>Nonresidential Functional Area or Type of Use</i> .
LOUNGE/RECREATION	See <i>Nonresidential Functional Area or Type of Use</i> .
LOW BAY	See <i>Nonresidential Functional Area or Type of Use, General commercial and industrial work</i> .
LOW-E COATING	is a low emissivity metallic coating applied to glazing in fenestration products. See <i>Soft Coat</i> and <i>Hard Coat</i> .
<u>LOW-GWP REFRIGERANT</u>	<u>is a compound used as a heat transfer fluid or gas that is: (A) any compound or blend of compounds, with a GWP Value less than 150; and (B) U.S. EPA Significant New Alternatives Policy (SNAP)-approved; and (C) not an ozone depleting substance as defined in Title 40 of the Code of Federal Regulations, Part 82, §82.3 (as amended March 10, 2009).</u>
LOW-RISE ENCLOSED SPACE	is an enclosed space located in a building with 3 or fewer stories.

Term	Definition
LOW-RISE RESIDENTIAL BUILDING	is a building, other than a hotel/motel that is of Occupancy Group R, Division 1, and is multi-family with three stories or less, or a single family residence of Occupancy Group R, Division 3, or an Occupancy Group U building located on a residential site.
LOW-SLOPED ROOF	is a roof that has a ratio of rise to run of 2:12 or less.
LPG	is liquefied petroleum gas. Propane is one type of LPG.
LUMENS/WATT	is the amount of light available from a given light source (lumens) divided by the power requirement for that light source (watts). The more usable light that a light source provides per watt, the greater its efficacy. See <i>Efficacy</i> .
LUMINAIRE	is a complete lighting unit consisting of a lamp(s) and the parts designed to distribute the light, to position and protect the lamp(s), and to connect the lamp(s) to the power supply; commonly referred to as "lighting fixtures."
MAIN ENTRY LOBBY	See <i>Nonresidential Functional Area or Type of Use, Lobby, Main entry</i> .
<u>MAKEUP AIR</u>	<u>is outdoor air deliberately brought into the building from the outside and supplied to the vicinity of an exhaust hood to replace air, vapor, and contaminants being exhausted. Makeup air is generally filtered and fan-forced, and it may be heated or cooled depending on the requirements of the application. Makeup air may be delivered through outlets integral to the exhaust hood or through outlets in the same room.</u>
MALL	See <i>Nonresidential Functional Area or Type of Use</i> .
MALL BUILDING	is a single building enclosing a number of tenants and occupants wherein two or more tenants have a main entrance into one or more malls.
MANDATORY MEASURES CHECKLIST (MF-1R)	is a form used by the building plan checker and field inspector to verify compliance of the building with the prescribed list of mandatory features, equipment efficiencies and product certification requirements. The documentation author indicates compliance by initialing, checking, or marking N/A (for features not applicable) in the boxes or spaces provided for the designer.
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 §110.0 through §110.9.
MARQUEE LIGHTING	See <i>Outdoor Lighting</i> .

Term	Definition
<i>MECHANICAL COOLING</i>	is lowering the temperature within a space using refrigerant compressors or absorbers, desiccant dehumidifiers, or other systems that require energy from depletable sources to directly condition the space. In nonresidential, high-rise residential, and hotel/motel buildings, cooling of a space by direct or indirect evaporation of water alone is not considered mechanical cooling.
<i>MECHANICAL HEATING</i>	is raising the temperature within a space using electric resistance heaters, fossil fuel burners, heat pumps, or other systems that require energy from depletable sources to directly condition the space.
<i>MEDICAL AND CLINICAL CARE</i>	See <i>Nonresidential Functional Area or Type of Use</i> .
<i>METAL BUILDING</i>	is a complete integrated set of mutually dependent components and assemblies that form a building, which consists of a steel-framed superstructure and metal skin. This does not include structural glass or metal panels such as in a curtainwall system.
<u><i>MICRO-CHANNEL CONDENSER</i></u>	<u>is an air-cooled condenser for refrigeration systems which utilizes multiple small parallel gas flow passages in a flat configuration with unitized fin surface between the gas passages, rather than round tubes arranged at a right angle to separate plate fins.</u>
<u><i>MINI-SPLIT AIR CONDITIONERS AND HEAT PUMPS</i></u>	<u>are systems that have a single outdoor section and one or more indoor sections. The indoor sections cycle on and off in unison in response to a single indoor thermostat.</u>
<u><i>MULTIPLE-SPLIT AIR CONDITIONERS AND HEAT PUMPS</i></u>	<u>are systems that have two or more indoor sections. The indoor sections operate independently and can be used to condition multiple zones in response to multiple indoor thermostats.</u>
<u><i>MULTIPLE ZONE SYSTEM</i></u>	<u>is an air distribution system that supplies air to more than one thermal zone each of which has one or more devices (such as dampers, cooling coils, and heating coils) that regulate airflow, cooling, or heating capacity to the zone.</u>
<i>MIXED OCCUPANCY BUILDING</i>	is a building designed and constructed for more than one type of occupancy, such as a three story building with ground floor retail and second and third floor residential apartments.

Term	Definition
<i>MODEL</i>	<p>is a single floor plan of a dwelling unit design. To be considered the same model; dwelling units shall be in the same subdivision or multi-family housing development and have the same energy designs and features, including the same floor area and volume. For multi-family buildings, variations in the exterior surface areas caused by the location of dwelling units within the building do not cause dwelling units to be considered different models.</p> <p>For purposes of establishing HERS sampling groups, variations in the basic floor plan layout, energy design, compliance features, zone floor area, or zone volume, that do not change the HERS features to be tested, the heating or cooling capacity of the HVAC unit(s), or the number of HVAC units specified for each dwelling unit, shall not cause dwelling units to be considered different models.</p>
<i>MODELING ASSUMPTIONS</i>	<p>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 as specified in the Alternative Calculation Methods Manuals.</p>
<i>MOTION SENSOR, LIGHTING</i>	<p>is a device that automatically turns lights off soon after an area is vacated. The term motion sensor applies to a device that controls outdoor lighting systems. When the device is used to control indoor lighting systems, it is termed an occupant sensor. The device also may be called an occupancy sensor, occupant-sensing device, or vacancy sensor.</p>
<i>MOVABLE SHADING DEVICE</i>	<p>See <i>Operable Shading Device</i>.</p>
<i>MULLION</i>	<p>is a vertical framing member separating adjoining window or door sections. See <i>Dividers</i>.</p>
<i>MULTI-FAMILY DWELLING UNIT</i>	<p>is a dwelling unit of occupancy type R, as defined by the CBC, sharing a common wall and/or ceiling/floor with at least one other dwelling unit.</p>
<i>MULTI-LEVEL LIGHTING CONTROL</i>	<p>is a lighting control that reduces lighting power in multiple steps while maintaining a reasonably uniform level of illuminance throughout the area controlled.</p>
<i>MULTIPLE ZONE</i>	<p>is a supply fan (and optionally a return fan) with heating and/or cooling heat exchangers (e.g. DX coil, chilled water coil, hot water coil, furnace, electric heater) that serves more than one thermostatic zone. Zones are thermostatically controlled by features including but not limited to variable volume, reheat, recool and concurrent operation of another system.</p>
<i>MULTISCENE PROGRAMMABLE SYSTEM</i>	<p>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.</p>
<i>MUNTINS</i>	<p>See <i>Dividers</i>.</p>

Term	Definition
MUSEUM	See <i>Nonresidential Functional Area or Type of Use</i> .
<u>NET EXHAUST FLOW RATE</u>	<u>is the exhaust flow rate for a hood, minus any internal discharge makeup air flow rate.</u>
NEWLY CONDITIONED SPACE	is any space being converted from unconditioned to directly conditioned or indirectly conditioned space. Newly conditioned space must comply with the requirements for an addition. See §141.09 for nonresidential occupancies and §150.2 for residential occupancies.
NEWLY CONSTRUCTED BUILDING	is a building that has never been used or occupied for any purpose.
NFRC	is the National Fenestration Rating Council. This is a national organization of fenestration product manufacturers, glazing manufacturers, manufacturers of related materials, utilities, state energy offices, laboratories, home builders, specifiers (architects), and public interest groups. This organization is designated by the Commission as the Supervisory Entity, which is responsible for rating the U-factors and solar heat gain coefficients of manufactured fenestration products (i.e., windows, skylights, glazed doors) that must be used in compliance calculations. See also <i>Fenestration Area and Fenestration Product</i> .
NFRC 100	is the National Fenestration Rating Council document entitled "NFRC 100: Procedure for Determining Fenestration Product U-factors." 2007; NFRC 100 includes procedures for site fenestration formerly included in a separate document, NFRC 100-SB)
NFRC 200	is the National Fenestration Rating Council document entitled "NFRC 200: Procedure for Determining Fenestration Product Solar Heat Gain Coefficients and Visible Transmittance at Normal Incidence." (2007)
NFRC 400	is the National Fenestration Rating Council document entitled "NFRC 400: Procedure for Determining Fenestration Product Air Leakage." (1995 or January 2002)
<u>NON-DUCTED SYSTEM</u>	<u>Is an air conditioner or heat pump that is designed to be permanently installed equipment and directly heats or cools air within the conditioned space using one or more indoor coils that are mounted on room walls and/or ceilings. The unit may be of a modular design that allows for combining multiple outdoor coils and compressors to create one overall system.</u>
NONDEPLETABLE SOURCES	is defined as energy that is not obtained from depletable sources. Also referred to as renewable energy, including solar and wind power. See <i>Energy Obtained from Nondepletable Sources</i> .

Term	Definition
NONRESIDENTIAL BUILDING	<p>is any building which is a Group A, B, E, F, H, M, S or U; Occupancy (when the Group U Occupancy is on a nonresidential site).</p> <p>NOTE: Requirements for high-rise residential buildings and hotels/motels are included in the nonresidential sections of Title 24, Part 6.</p>
<u>NONRESIDENTIAL BUILDING OCCUPANCY TYPES</u>	<p><u>are buildings in which a minimum of 90 percent of the area functions as one of the following:</u></p> <p><u>Auditorium Building is a public building with fixed seating used for public meetings or gatherings, not specifically for the viewing of dramatic performances.</u></p> <p><u>Classroom Building is a building used by an organization that provides instruction to students for which a minimum of 90 percent of the building floor area is classrooms, educational workshops, and educational labs; and supporting corridors, stairways, and restrooms.</u></p> <p><u>Commercial and Industrial Storage Building is a building used for storing items.</u></p> <p><u>Convention Center Building is a building for which the primary function is for meetings, conventions and multiple purposes, and that have neither fixed seating nor fixed staging.</u></p> <p><u>Financial Institution Building is a public building 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.</u></p> <p><u>General Commercial and Industrial Work Building is a building for an art, craft, assembly or manufacturing operation is performed.</u></p> <p><u>Grocery Store Building is a building for the sale of foodstuffs requiring additional preparation prior to consumption.</u></p> <p><u>Library Building is a building which is primarily a repository for literary materials, such as books, periodicals, newspapers, pamphlets and prints, kept for reading or reference.</u></p> <p><u>Medical Buildings and Clinic Buildings are non-“I” occupancy buildings where medical or clinical care is provided, does not provide overnight patient care, and is used to provide physical and mental care through medical, dental, or psychological examination and treatment.</u></p> <p><u>Office Building is a building of CBC Group B Occupancy which is other than a restaurant.</u></p>

Term	Definition
	<p>Parking Garage Building is a building for the purpose of parking vehicles, which consists of at least a roof over the parking area enclosed with walls on all sides. Parking garages may have fences, rails, partial walls, or other barriers in place of one or more walls. The building has an entrance(s) and exit(s), and includes areas for vehicle maneuvering to reach the parking spaces. If the roof of a parking structure is also used for parking, the section without an overhead roof is considered a parking lot instead of a parking garage.</p> <p>Religious Facility Building is a building in which the primary function is for assembly of people to worship.</p> <p>Restaurant Building is a building in which the primary function is a food establishment as defined in Section 27520 of the Health and Safety Code.</p> <p>School Building is a building that is used by an organization that provides instruction to students, which is not a Classroom Building as defined in Section 100.1, and may include an auditorium, gymnasium, kitchen, library, multi-purpose room, dining and cafeteria, student union, or maintenance staff workroom. A maintenance or storage building is not a school building.</p> <p>Theater Building is a building in which the primary function is assembly, having tiers of rising seats or steps for the viewing of motion pictures, dramatic performances, lectures, musical events and similar live performances.</p>
<i>NONRESIDENTIAL COMPLIANCE MANUAL</i>	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.
<i>NONRESIDENTIAL FUNCTION AREAS OR TYPE OF USE</i>	<p>is one of the include the following:</p> <p>Aisle Way is a warehouse facility term describing a long, usually narrow space between storage racks.</p> <p>Atrium is a large-volume space created by openings connecting two or more stories and is used for purposes other than an enclosed stairway, an elevator hoistway, an escalator opening, or as a utility shaft for plumbing, electrical, air-conditioning or other equipment and is not a mall.</p> <p>Auditorium Room is 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.</p> <p>Auto rRepair is the portion of a building a room or area used to repair automotive equipment and/or vehicles, exchange parts, and may include work using</p>

Term	Definition
	<p>an open flame or welding equipment.</p> <p>Beauty Salon is a room or area in which the primary activity is manicures, pedicures, facials, or the cutting or styling of hair. Also <u>may be</u> known as <u>a</u> beauty shop or beauty parlor.</p> <p>Civic mMeeting pPlace is a <u>room or area which is a</u> city council or board of supervisors meeting chamber, courtroom, or other official meeting <u>spacearea</u> accessible to the public.</p> <p>Classroom Building is a building or group of buildings that is predominately classrooms used by an organization that provides instruction to students, which may include corridors and stairways, restrooms and small storage closets, faculty offices, and workshops and labs. A classroom building does not include buildings that are not predominantly classroom, including auditorium, gymnasium, kitchen, library, multi-purpose, dining and cafeteria, student union, maintenance staff workroom, or storage buildings.</p> <p>Classroom, lLecture, tTraining, vVocational fRoom is a room or area where an audience or class receives instruction.</p> <p>Commercial and iIndustrial sStorage is a room, <u>area or area</u>, or building used for storing items.</p> <p>Convention, conference, multipurpose and meeting centers is 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.</p> <p>Corridor is a passageway or route into which compartments or rooms open.</p> <p>Dining is a room or <u>rooms area</u> in a restaurant or hotel/motel (other than guest rooms) where meals that are served to the customers will be consumed.</p> <p>Dormitory is a building consisting of multiple sleeping quarters and having interior common areas such as dining rooms, reading rooms, exercise rooms, toilet rooms, study rooms, hallways, lobbies, corridors, and stairwells, other than high-rise residential, low-rise residential, and hotel/motel occupancies.</p> <p>Electrical/mMechanical/tTelephone fRoom is a room in which the building's electrical switchbox or control panels, telephone switchbox, and/or HVAC controls or equipment is located.</p> <p>Exercise cCenter/gGymnasium is a room or <u>buildingarea</u> equipped for gymnastics, exercise equipment, or indoor athletic activities.</p> <p>Exhibit is a room or area that <u>has for its primary purpose</u> is used for exhibitions, having that has neither fixed seating nor fixed staging. <u>An exhibit</u></p>

Term	Definition
	<p>does not include a gallery or other place where art is for sale. An exhibit does not include a lobby, conference room, or other occupancies where the primary function is not exhibitions.</p> <p>Financial institution is a public establishment used 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.</p> <p>Financial Transactions Areas is a room or area for the tellers-area, work stations, and customer waiting areas to complete financial transactions. Financial transaction areas do not include private offices, hallways, restrooms, or other support areas.</p> <p>General Commercial and Industrial Work Area is a room or area, or building in which an art, craft, assembly or manufacturing operation is performed.</p> <p>High bay: Where the luminaires are 25 feet or more above the floor.</p> <p>Low bay: Where the luminaires are less than 25 feet above the floor.</p> <p>Precision: Where 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 are done.</p> <p>Grocery Sales Area is a room, or area, or building that has as its primary purpose the sale of foodstuffs requiring additional preparation prior to consumption.</p> <p>Grocery store is a building that has as its primary purpose the sale of foodstuffs requiring additional preparation prior to consumption.</p> <p>Hotel Function Area is a hotel room or area such as a hotel ballroom, meeting room, exhibit hall or conference room, together with pre-function areas and other spaces ancillary to its function.</p> <p>Housing, Public and Commons Areas is housing other than Occupancy Group I that are living quarters. Commons areas may include dining, reading, study, library or other community spaces and/or medical treatment or hospice facilities.</p> <p>Multi-family: A multi-family building contains multiple dwelling units that share common walls and may also share common floors or ceilings (apartments).</p> <p>Dormitory: A space in a building where group sleeping accommodations are provided in one room, or in a series of closely associated rooms, for persons not members of the same family group, under joint occupancy and single management, as in college dormitories or fraternity houses.</p>

Term	Definition
	<p>Senior housing: Is specifically for habitation by seniors, including but not limited to independent living quarters, and assisted living quarters.</p>
	<p>Kitchen/food preparation is a room or area with cooking facilities and/or an area where food is prepared.</p>
	<p>Laboratory, Scientific is a room or area where research, experiments, and measurement in medical and physical sciences are performed requiring examination of fine details. The area may include workbenches, countertops, scientific instruments, and associated floor spaces. Scientific laboratory does not refer to film, computer, and other laboratories where scientific experiments are not performed.</p>
	<p>Laundry is a room or area where laundering activities occur.</p>
	<p>Library Area is a room or area with a repository for literary materials, such as books, periodicals, newspapers, pamphlets and prints, kept for reading or reference.</p>
	<p>Reading areas: Is a library facility term describing room or areas within a prescribed building space in a library containing tables, chairs, or desks for library patrons to use for the purpose of reading books and other reference documents. Library reading areas include reading, circulation, and checkout areas. Reading areas do not include private offices, meeting, photocopy, or other rooms not used specifically for reading by library patrons.</p>
	<p>Stacks Area: Is a room or area in a library facility term describing a with large grouping of shelving sections within a prescribed building space. Stack aisles include pedestrian paths located in stack areas. Book stack aisle lighting is typically a central aisle luminaire distributing light to stack faces on both sides of an aisle.</p>
	<p>Laboratory, Scientific is a space or facility where research, experiments, and measurement in medical and physical sciences are performed requiring examination of fine details. The space may include workbenches, countertops, scientific instruments, and associated floor spaces. Scientific laboratory does not refer to film, computer, and other laboratories where scientific experiments are not performed.</p>
	<p>Lobby,</p>
	<p>Hotel: Is the contiguous area space in a hotel/motel between the main entrance and the front desk, including reception, waiting and seating areas.</p>
	<p>Main eEntry: Is the contiguous space area in buildings other than hotel/motel that is directly</p>

Term	Definition
	<p>located by the main entrance of the building through which persons must pass, including reception, waiting and seating areas.</p> <p>Locker/Dressing Room is a room or area for changing clothing, sometimes equipped with lockers.</p> <p>Lounge/Recreation is a room <u>or area</u> used for leisure activities which may be associated with a restaurant or bar.</p> <p>Mall is a roofed or covered common pedestrian area within a mall building that serves as access for two or more tenants.</p> <p>Medical and Clinical Care Area is a non “I” occupancy room or area in a building that does not provide overnight patient care and that is used to provide physical and mental care through medical, dental, or psychological examination and treatment, including, but not limited to, laboratories and treatment spaces.</p> <p>Medical buildings and clinics is a building where medical and clinical care is provided.</p> <p>Museum is a space<u>room or area</u> in which the primary function is the care or exhibit of works of artistic, historical, or scientific value. A museum does not include a gallery or other place where art is for sale. A museum does not include a lobby, conference room, or other occupancies where the primary function is not the care or exhibit of works of artistic, historical, or scientific value.</p> <p>Office Area is a room, area, or building of CBC Group B Occupancy other than restaurants.</p> <p><u>Open Area is a warehouse facility term describing a large unobstructed area that is typically used for the handling and temporary storage of goods.</u></p> <p>Parking Garage Area is a covered building or structure for the purpose of parking vehicles, which consists of at least a roof over the parking area enclosed with walls on all sides. Parking garages may have fences, rails, partial walls, or other barriers in place of one or more walls. The structure has an entrance(s) and exit(s), and includes areas for vehicle maneuvering to reach the parking spaces. If the roof of a parking structure is also used for parking, the section without an overhead roof is considered a parking lot instead of a parking garage. <u>Parking garages may include the following areas:</u></p> <p><u>Daylight Transition Zone is the interior path of travel for vehicles to enter a parking garage as needed to transition from exterior daylight levels to interior light levels. Daylight Transition Zones only include the path of vehicular travel and do not include adjacent Parking Areas.</u></p> <p><u>Dedicated Ramps are driveways specifically for</u></p>

Term	Definition
	<p><u>the purpose of moving vehicles between floors of a parking garage and which have no adjacent parking. Dedicated ramps do not include sloping floors of a parking structure, which are considered Parking Areas.</u></p> <p>Parking Areas: <u>Are areas of a parking garage used only for the purpose of parking and maneuvering of vehicles on a single floor. Parking areas include sloping floors of a parking structure. Parking areas do not include Daylight Transition Zones, Dedicated Ramps, or and which is not the roof of a parking structure.</u></p> <p>Ramps and Entries: Parking ramps are driveways for the purpose of moving vehicles between floors of a parking garage. Parking entries are driveways for the purpose of vehicles entering into a parking garage.</p> <p>Religious facility is a building in which the primary function is for an assembly of people to worship. Religious facilities do not include classroom, housing, or gymnasium buildings.</p> <p>Religious wWorship Area is a room, or area, or building in which the primary function is for an assembly of people to worship. Religious worship does not include classrooms, offices, or other areas in which the primary function is not for an assembly of people to worship.</p> <p>Restaurant is a room, area, or building that is a food establishment as defined in Section 27520 of the Health and Safety Code.</p> <p>Restroom is a room or suite of rooms providing personal facilities such as toilets and washbasins.</p> <p>Retail mMerchandise sSales Area is a room, or area, or building in which the primary activity is the sale of merchandise.</p> <p>School is a building or group of buildings that is used by an organization that provides instruction to students, which is predominately classroom buildings but may also include auditorium, gymnasium, kitchen, library, multi-purpose rooms, dining and cafeteria, student union, maintenance staff workroom, and small storage spaces.</p> <p>Stairs is a series of steps providing passage from one level of a building to another, including escalators.</p> <p><u>Stairwell is a vertical shaft in which stairs are located.</u></p> <p>Support aArea is a room or area used as a passageway, utility room, storage space, or other type of space associated with or secondary to the function of an occupancy that is listed in these regulations.</p> <p>Tenant lLease sSpace is a portion of room or area in a building intended for lease for which a specific tenant is not identified at the time of permit application.</p>

Term	Definition
	<p>Theater Area</p> <p>Motion Picture: Is an assembly room <u>or area</u>, a hall, or a building with tiers of rising seats or steps for the showing of motion pictures.</p> <p>Performance: Is an assembly room <u>or area</u>, a hall, or a building with tiers of rising seats or steps for the viewing of dramatic performances, lectures, musical events and similar live performances.</p> <p>Transportation Function Area is the ticketing area, waiting area, baggage handling areas, concourse, or other areas not covered by primary functions in Standards Table 146-C in an airport terminal, bus or rail terminal or station, subway or transit station, or a marine terminal.</p> <p>Videoconferencing Studio is a room with permanently installed videoconferencing cameras, audio equipment, and playback equipment for both audio-based and video-based two-way communication between local and remote sites.</p> <p>Vocational Area room is a room <u>or area</u> used to provide training in a special skill to be pursued as a trade.</p> <p>Waiting Area is an area other than a hotel lobby or main entry lobby normally provided with seating and used for people waiting.</p> <p>Wholesale Showroom is a room <u>or area</u> where samples of merchandise are displayed.</p>
<i>NONSTANDARD PART LOAD VALUE (NPLV)</i>	is a single-number part-load efficiency figure of merit for chillers referenced to conditions other than IPLV conditions. (See "Integrated Part Load Value")
<i>NORTH-FACING</i>	See <i>Orientation</i> .
<i>NSHP GUIDEBOOK</i>	is the California Energy Commission document entitled "New Solar Home Partnership Guidebook" that is in effect at the time of application for the building permit.
<i>OCCUPANT SENSOR, LIGHTING</i>	is a device that automatically turns lights off soon after an area is vacated. The term occupant sensor applies to a device that controls indoor lighting systems. When the device is used to control outdoor lighting systems, it is termed a motion sensor. The device also may be called an occupancy sensor, occupant-sensing device, or vacancy sensor.
<u><i>OCCUPIABLE SPACE</i></u>	<u>is any enclosed space inside the pressure boundary and intended for human activities, including, but not limited to, all habitable spaces, toilets, closets, halls, storage and utility areas, and laundry areas.</u>
<i>OFFICE</i>	See <i>Nonresidential Functional Area or Type of Use</i> .

Term	Definition
OPEN COOLING TOWER	is an open, or direct contact cooling tower which exposes water directly to the cooling atmosphere, thereby transferring the source heat load from the water directly to the air by a combination of heat and mass transfer.
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.
ORIENTATION, CARDINAL	is one of the four principal directional indicators, north, east, south, and west, which are marked on a compass. Also called cardinal directions.
ORIENTATION, 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).
ORIENTATION, 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).
ORIENTATION, 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).
ORIENTATION, 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).
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.
ORNAMENTAL LIGHTING	See <i>Outdoor Lighting</i> .
OUTDOOR AIR (OUTSIDE AIR)	is air taken from outdoors and not previously circulated in the building.
OUTDOOR LIGHTING	<p><u>Is electrical lighting used to illuminate outdoor areas, and includes the following areas</u> definitions include the following:</p> <p>Building entrance is any operable doorway in or out of a building, including overhead doors.</p> <p>Building façade is the exterior surfaces of a building, not including horizontal roofing, signs, and surfaces not visible from any reasonable viewing location.</p> <p>Canopy is a permanent structure, other than a parking garage as defined in §100.1, consisting of a roof and supporting building elements, with the area beneath at least partially open to the elements. A canopy may be freestanding or attached to surrounding structures. A canopy roof may serve as the floor of a structure above.</p> <p>Carport is a covered, open-sided structure used</p>

Term	Definition
	solely for the purpose of parking vehicles, consisting of a roof over the parking area. Typically, carports are free-standing or projected from the side of the building and are only two or fewer car lengths deep.
	Hardscape is an improvement to a site that is paved or has other structural features, including but not limited to, curbs, plazas, entries, parking lots, site roadways, driveways, walkways, sidewalks, bikeways, water features and pools, storage or service yards, loading docks, amphitheaters, outdoor sales lots, and private monuments and statuary.
	Landscape lighting is lighting that is recessed into or mounted on the ground, paving, or raised deck, which is mounted less than 42 inches above grade or mounted onto trees or trellises, and that is intended to be aimed only at landscape features.
	Lantern is an ornamental outdoor luminaire that uses an electric lamp to replicate a pre-electric lantern, which used a flame to generate light.
	Lighting zone is a geographic area designated by the California Energy Commission that determines requirements for outdoor lighting, including lighting power densities and specific control, equipment or performance requirements. Lighting zones are numbered LZ1, LZ2, LZ3, and LZ4.
	Marquee lighting is a permanent lighting system consisting of one or more rows of many small lights, including light emitting diodes (LEDs), or fiber optic lighting, attached to a canopy.
	Ornamental lighting is post-top luminaires, lanterns, pendant luminaires, chandeliers, and marquee lighting.
	Outdoor lighting is all electrical lighting for parking lots, signs, building entrances, outdoor sales areas, outdoor canopies, landscape lighting, lighting for building facades and hardscape lighting.
	Outdoor sales frontage is the portion of the perimeter of an outdoor sales area immediately adjacent to a street, road, or public sidewalk.
	Outdoor sales lot is an uncovered paved area used exclusively for the display of vehicles, equipment or other merchandise for sale. All internal and adjacent access drives, walkway areas, employee and customer parking areas, vehicle service or storage areas are not outdoor sales lot areas, but are considered hardscape.
	Parking lot is an uncovered area for the purpose of parking vehicles. Parking lot is a type of hardscape.
	Paved area is an area that is paved with concrete, asphalt, stone, brick, gravel, or other improved wearing surface, including the curb.
	Pendant is a mounting method in which the luminaire

Term	Definition
	<p>is suspended from above.</p> <p>Post Top Luminaire is an ornamental outdoor luminaire that is mounted directly on top of a lamp-post.</p> <p>Principal viewing location is anywhere along the adjacent highway, street, road or sidewalk running parallel to an outdoor sales frontage</p> <p>Public monuments are statuary, buildings, structures, and/or hardscape on public land.</p> <p>Sales canopy is a canopy specifically to cover and protect an outdoor sales area.</p> <p>Stairways and Ramps. Stairways are one or more flights of stairs with the necessary landings and platforms connecting them to form a continuous and uninterrupted passage from one level to another. An exterior stairway is open on at least one side, except for required structural columns, beams, handrails and guards. The adjoining open areas shall be either yards, courts or public ways. The other sides of the exterior stairway need not be open. Ramps are walking surfaces with a slope steeper than 5 percent.¹</p> <p>Vehicle service station is a gasoline, natural gas, diesel, or other fuel dispensing station.</p>
<u>OUTDOOR LIGHTING ZONE</u>	<u>is a geographic area designated by the California Energy Commission that determines requirements for outdoor lighting, including lighting power densities and specific control, equipment or performance requirements. Lighting zones are numbered LZ1, LZ2, LZ3, and LZ4.</u>
OUTDOOR SALES FRONTAGE	See <i>Outdoor Lighting</i> .
OUTDOOR SALES LOT	See <i>Outdoor Lighting</i> .
OUTSIDE AIR	See <i>Outdoor Air</i> .
PACKAGED AIR CONDITIONER OR HEAT PUMP	is an air conditioner or heat pump that combines both the condenser and air handling capabilities in a single enclosure or package.
PANEL SIGN	See <i>Sign, Cabinet</i> .
<u>PARALLEL FAN-POWERED TERMINAL UNIT</u>	<u>is a terminal unit that combines a VAV damper in parallel with a fan that only runs when the terminal unit is providing heating to the space.</u>
PARKING GARAGE	See <i>Nonresidential Functional Area or Type of Use</i> .
PARKING LOT	See <i>Outdoor Lighting</i> .
PART 6	is Title 24, Part 6 of the California Code of Regulations. See <i>Building Energy Efficiency Standards</i> .
<u>PART-LOAD OPERATION</u>	<u>occurs when a loaded air compressor is operating below its maximum rated capacity.</u>

Term	Definition
<u>PARTICLE SIZE EFFICIENCY</u>	is the fraction (percentage) of particles that are captured on air filter equipment as determined during rating tests conducted in accordance with ASHRAE Standard 52.2 or AHRI Standard 680. Particle Size Efficiency is measured in three particle size ranges: 0.3-1.0, 1.0-3.0, 3.0-10 microns.
PARTY PARTITION	is a wall, floor, or ceiling that separates the conditioned spaces of two different tenants.
PAVED AREA	See <i>Outdoor Lighting</i> .
PENDANT	See <i>Outdoor Lighting</i> .
PERM	is equal to 1 grain of water vapor transmitted per 1 square foot per hour per inch of mercury pressure difference.
PERMANENTLY ATTACHED	is attached with fasteners that require additional tools to remove (as opposed to clips, hooks, latches, snaps, or ties).
<u>PERMANENTLY INSTALLED LIGHTING</u>	includes all luminaires attached to the inside or outside of a building or site, including track and flexible lighting system; lighting attached to walls, ceilings, columns, inside or outside of permanently installed cabinets, internally illuminated case work, mounted on poles, in trees, or in the ground; attached to ceiling fans and integral to exhaust fans that are other than exhaust hoods for cooking equipment. Permanently installed luminaires may have either plug-in or hardwired connections for electric power. Permanently installed lighting does not include portable lighting or lighting that is installed by the manufacturer in refrigerators, stoves, and microwave ovens, exhaust hoods for cooking equipment, refrigerated cases, vending machines, food preparation equipment, and scientific and industrial equipment.
PHOTOCONTROL	is an electric device that detects changes in illumination levels then controls lighting load at predetermined illumination levels.
PLENUM	is an air compartment or chamber, including uninhabited crawl space, areas above a ceiling or below a floor, including air spaces below raised floors of computer/data processing centers, or attic spaces, to which one or more ducts are connected and which forms part of either the supply-air, return-air or exhaust air system, other than the occupied space being conditioned.
POOLS, ANSI/NSPI-5	is the American National Standards Institute and National Spa and Pool Institute document entitled "American National Standard for Residential Inground Swimming Pools" 2003 (ANSI/NSPI-5 2003).

Term	Definition
<i>POOLS, AUXILIARY POOL LOADS</i>	are features or devices that circulate pool water in addition to that required for pool filtration, including, but not limited to, solar pool heating systems, filter backwashing, pool cleaners, waterfalls, fountains, and spas.
<i>POOLS, BACKWASH VALVE</i>	is a diverter valve designed to backwash filters located between the circulation pump and the filter, including, but not limited to, slide, push-pull, multi-port, and full-flow valves.
<i>POOLS, MULTI-SPEED PUMP</i>	is a pump capable of operating at two (2) or more speeds and includes two-speed and variable-speed pumps.
<i>POOLS, NSF/ANSI 50</i>	is the NSF International (formerly National Sanitation Foundation) Standard and American National Standards Institute document entitled "Circulation System Components and Related Materials for Swimming Pools, Spas/Hot Tubs" 2005 (NSF/ANSI 50 – 2005).
<i>POOLS, RESIDENTIAL</i>	are permanently installed residential in-ground swimming pools intended to use by a single-family home for noncommercial purposes and with dimensions as defined in ANSI/NSPI-5.
<i>POOR QUALITY LIGHTING TASKS</i>	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.
<i>PORTABLE LIGHTING</i>	is lighting with plug-in connections for electric power that is table and freestanding floor lamps, attached to modular furniture, workstation task lights, lights attached to workstation panels, movable displays, and other equipment that is not permanently installed lighting.
<i>POST TOP LUMINAIRE</i>	See <i>Outdoor Lighting</i> .
<i>PRECISION COMMERCIAL OR INDUSTRIAL WORK</i>	See <i>Nonresidential Functional Area or Type of Use</i> .
<i><u>PRESSURE BOUNDARY</u></i>	<i>is the primary air enclosure boundary separating indoor and outdoor air. For example, a volume that has more leakage to the outside than to the conditioned space would be considered outside the pressure boundary. Exposed earth in a crawlspace or basement shall not be considered part of the pressure boundary.</i>
<i>PRIMARY AIRFLOW</i>	is the airflow (cfm or L/s) supplied to the zone from the air-handling unit at which the outdoor air intake is located. It includes outdoor intake air and recirculated air from that air-handling unit but does not include air transferred or air recirculated to the zone by other means.

Term	Definition
<u>PRIMARY STORAGE</u>	<u>is compressed air storage located between the compressors and any dryers or other conditioning equipment.</u>
PRINCIPAL VIEWING LOCATION	See <i>Outdoor Lighting</i> .
PRIVATE OFFICE OR WORK AREA	is an office bounded by 72-inches or higher permanent partitions and is no more than 200 ft ² . See <i>Nonresidential Functional Area or Type of Use</i> .
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.
PROCESS SPACE	is a space that is thermostatically controlled to maintain a process environment temperature less than 55° F or to maintain a process environment temperature greater than 90° F for the whole space that the system serves, or that is a space with a space conditioning system designed and controlled to be incapable of operating at temperatures above 55° F or incapable of operating at temperatures below 90° F at design conditions.
<u>PROCESS, COVERED</u>	<u>are processes that are regulated under Part 6, which include datacom equipment, laboratory exhaust, garage exhaust, commercial kitchen ventilation, refrigerator warehouses, supermarket refrigeration systems, compressed air systems, process cooling towers, process boilers.</u>
<u>PROCESS, EXEMPT</u>	<u>is process that is not listed as a covered process.</u>
<u>PROCESS LOAD, COVERED</u>	<u>is a load resulting from a covered process</u>
<u>PROCESS LOAD, EXEMPT</u>	<u>is a load resulting from an exempt process.</u>
PROPOSED DESIGN	is the proposed building design which must comply with the standards before receiving a building permit. See also <i>Energy Budget and Standard Design</i> .
<u>PROPOSED DESIGN BUILDING</u>	<u>the proposed building being modeled using rules described in the Alternative Calculation Method Manual. In order for a building to comply with the standards, the proposed building energy use must be less than or equal to the Standard Design Building energy use and meet the mandatory requirements in the Title 24 Building Energy Efficiency Standards.</u>
PUBLIC ADVISER	is the Public Adviser of the Commission.
PUBLIC AREAS	are spaces generally open to the public at large, customers or congregation members, or similar spaces where occupants need to be prevented from controlling lights for safety, security, or business reasons.
PUBLIC MONUMENTS	See <i>Outdoor Lighting</i> .

Term	Definition
<u>R-VALUE</u>	<u>is the measure of the thermal resistance of insulation or any material or building component expressed in ft²-hr-oF/Btu.</u>
RADIANT BARRIER	is a highly reflective, low emitting material installed at the underside surface of the roof deck and the inside surface of gable ends or other exterior vertical surfaces in attics to reduce <u>the summer</u> solar heat gain <u>and the winter heat loss.</u> into the attic.
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.
REAR	See <i>Back</i> .
RECOOL	is the cooling of air that has been previously heated by space-conditioning equipment or systems serving the same building.
RECORD DRAWINGS	are drawings that document the as installed location and performance data on all lighting and space conditioning system components, devices, appliances and equipment, including but not limited to wiring sequences, control sequences, duct and pipe distribution system layout and sizes, space conditioning system terminal device layout and air flow rates, hydronic system and flow rates, and connections for the space conditioning system. Record drawings are sometimes called "as built."
RECOVERED ENERGY	is energy used in a building that (1) is 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.
RECOVERY EFFICIENCY	is one measure of the efficiency of water heaters. It is required for water heating energy calculations for some types of water heaters. It is a measure of the percentage of heat from combustion of gas or oil which is transferred to the water. For non-storage type water heaters, the recovery efficiency is really a thermal efficiency.
REDUCED FLICKER OPERATION	is the operation of a light, in which the light has a visual flicker less than 30 percent, for frequency and modulation.
REFERENCE APPENDICES	is the support document for the Building Energy Efficiency Standards and the ACM Approval Manuals. The document consists of three sections: the Reference Joint Appendices (JA), the Reference Residential Appendices (RA), and the Reference Nonresidential Appendices (NA).

Term	Definition
REFERENCE COMPUTER PROGRAM	is the reference method against which other methods are compared. For the Nonresidential Standards, the reference computer program is DOE 2.1E. For the low-rise Residential Standards the reference computer program is CALRES.
REFLECTANCE, SOLAR	is the ratio of the reflected solar flux to the incident solar flux.
REFRIGERANT CHARGE	is to the amount of refrigerant that is installed or “charged” into an air conditioner or heat pump. The <i>refrigerant</i> is the working fluid. It is compressed and becomes a liquid as it enters the condenser. The hot liquid is cooled in the condenser and flows to the evaporator where it released through the expansion valve. When the pressure is released, the refrigerant expands into a gas and cools. Air is passed over the evaporator to provide the space cooling. When an air conditioner or heat pump has too much refrigerant (overcharged) the compressor may be damaged. When an air conditioner has too little refrigerant (undercharged), the efficiency of the unit is reduced. A <i>thermostatic expansion valve (TXV)</i> can mitigate the impact of improper refrigerant charge.
REFRIGERATED CASE	is a manufactured commercial refrigerator or freezer, including but not limited to display cases, reach-in cabinets, meat cases, and frozen food and soda fountain units.
REFRIGERATED SPACE	is a building or a space that is a refrigerated warehouse, walk-in cooler, or a freezer.
REFRIGERATED WAREHOUSE	is a building or a space constructed for storage of products, where mechanical refrigeration is used to maintain the space temperature at 55° F or less.
REGISTERED DOCUMENT	means the document has been submitted to a HERS provider <u>residential or nonresidential</u> data registry <u>for retention</u> , and the <u>data</u> registry has assigned a unique registration number to the document. The image of the registered document is accessible for printing or viewing to by registered <u>authorized</u> users of the provider's data registry via the <u>registration</u> provider's internet website. The <u>registered</u> document's unique <u>visible</u> registration number is embedded <u>appended</u> onto the document image by the provider's data registry automated functions .

Term	Definition
<u>REGISTRATION PROVIDER</u>	<u>is an entity that has been approved by the Energy Commission or the Executive Director to provide data registry services. Registration Providers shall maintain data registries that conform to the requirements in Reference Joint Appendix JA7, and the specifications in the Data Registry Requirements Manual(s) approved by the Energy Commission. The Registration Provider for a Residential Data Registry shall be a HERS Provider approved by the Energy Commission.</u>
REHEAT	is the heating of air that has been previously cooled by cooling equipment or supplied by an economizer.
RELATIVE SOLAR HEAT GAIN	is the ratio of solar heat gain through a fenestration product (corrected for external shading) to the incident solar radiation. Solar heat gain includes directly transmitted solar heat and absorbed solar radiation, which is then reradiated, conducted, or convected into the space.
RELIGIOUS WORSHIP	See <i>Nonresidential Functional Area or Type of Use</i> .
RELOCATABLE PUBLIC SCHOOL BUILDING	is a relocatable building as defined by Title 24, Part 1, Section 4-314, which is subject to Title 24, Part 1, Chapter 4, Group 1.
REPAIR	is the reconstruction or renewal for the purpose of maintenance of any component, system, or equipment of an existing building. Replacement of any component, system, or equipment for which there are requirements in the standards is considered an alteration and not a repair.

Term	Definition
<u>REPLACEMENT AIR</u>	<p><u>is outdoor air that is used to replace air removed from a building through an exhaust system. Replacement air may be derived from one or more of the following: makeup air, supply air, transfer air, and infiltration. However, the ultimate source of all replacement air is outdoor air. When replacement air exceeds exhaust, the result is exfiltration.</u></p> <p><u>MAKEUP AIR is dedicated replacement air deliberately brought into the building from the outdoors and supplied to the vicinity of an exhaust hood to replace the air and cooking effluent being exhausted. Makeup air is generally filtered and fan-forced, and it may be heated or cooled depending on the requirements of the application. Makeup air may be delivered through outlets integral to the exhaust hood (compensating hoods) or through outlets in the same room.</u></p> <p><u>SUPPLY AIR is air entering a space from an air-conditioning, heating, or ventilating system for the purpose of comfort conditioning. Supply air is generally filtered, fan-forced, and heated, cooled, humidified or dehumidified as necessary to maintain specified temperature and humidity conditions. Only the quantity of outdoor air within the supply airflow is used as replacement air.</u></p> <p><u>TRANSFER AIR is air transferred from one room to another through openings in the room envelope, whether it is transferred intentionally or not. The driving force for transfer air is generally a small pressure differential between the rooms, although one or more fans may be used.</u></p> <p><u>INFILTRATION is leakage or flow of outdoor air into the building or space through openings in the building or space envelope, whether intentional or unintentional. The driving force for infiltration is a negative pressure in a space or building relative to the exterior of the building envelope.</u></p>
RESIDENTIAL BUILDING	See “high-rise residential building” and “low-rise residential building.”
RESIDENTIAL COMPLIANCE MANUAL	is the manual developed by the commission, under Section 25402.1 of the Public Resources Code, to aid designers, builders, and contractors in meeting energy efficiency standards for low-rise residential buildings.
RESIDENTIAL SPACE TYPE	<p>is one of the following:</p> <p>Bathroom is a room or area containing a sink used for personal hygiene, toilet, shower, or a tub.</p>

Term	Definition
	<p>Closet is a non-habitable room used for the storage of linens, household supplies, clothing, non-perishable food, or similar uses, and which is not a hallway or passageway.</p> <p>Garage is a non-habitable building or portion of building, attached to or detached from a residential dwelling unit, in which motor vehicles are parked.</p> <p>Kitchen is a room or area used for cooking, food storage and preparation and washing dishes, including associated counter tops and cabinets, refrigerator, stove, ovens, and floor area.</p> <p>Laundry is a non-habitable room or space which contains plumbing and electrical connections for a washing machine or clothes dryer.</p> <p>Storage Building is a non-habitable detached building used for the storage of tools, garden equipment, or miscellaneous items.</p> <p>Utility Room is a non-habitable room or building which contains only HVAC, plumbing, or electrical controls or equipment; and which is not a bathroom, closet, garage, or laundry room.</p>
RESTAURANT	See <i>Nonresidential Functional Area or Type of Use</i> .
RESTROOM	See <i>Nonresidential Functional Area or Type of Use</i> .
RETAIL MERCHANDISE SALES	See <i>Nonresidential Functional Area or Type of Use</i> .
RIGHT SIDE	is the right side of the building as one faces the front facade from the outside (see <i>Front</i>). This designation is used to indicate the orientation of fenestration and other surfaces, especially in model homes that are constructed in multiple orientations.
ROOF	is the outside cover of a building or structure including the structural supports, decking, and top layer that is exposed to the outside with a slope less than 60 degrees from the horizontal.
ROOF, LOW-SLOPED	is a roof that has a ratio of rise to run of 2:12 or less (9.5 degrees from the horizontal).
ROOF, STEEP-SLOPED	is a roof that has a ratio of rise to run of greater than 2:12 (9.5 degrees from the horizontal).
<u>ROOF RECOVER BOARD</u>	<u>is a rigid type board, typically 1/4 inch to 3/4 inch thick, installed directly below a low-sloped roof membrane, with or without above deck thermal insulation, to improve a roof system's compressive strength or to physically separate the roof membrane from the thermal insulation or to physically separate a new roof covering from an underlying roof membrane as part of a roof overlay project.</u>
ROOFING PRODUCT	is the top layer(s) of the roof that is exposed to the outside, which has properties including but not limited to <u>solar</u> reflectance, <u>thermal</u> emittance, and mass.

Term	Definition
RUNOUT	is piping that is no more than 12 feet long and that connects to a fixture or an individual terminal unit.
R-VALUE	is the measure of the thermal resistance of insulation or any material or building component expressed in (ft ² -hr °F)/Btu. See <i>Thermal Resistance</i> .
SALES CANOPY	See <i>Outdoor Lighting</i> .
<u>SATURATED CONDENSING TEMPERATURE (CONDENSING TEMPERATURE)</u>	<u>is the saturation temperature corresponding to the refrigerant pressure at the condenser entrance for single component and azeotropic refrigerants. For zeotropic refrigerants, the arithmetic average of the Dew Point and Bubble Point temperatures corresponding to the refrigerant pressure at the condenser entrance.</u>
SC	See <i>Shading Coefficient</i> .
SCHOOL	See <i>Nonresidential Functional Area or Type of Use</i> .
SCIENTIFIC EQUIPMENT	is measurement, testing or metering equipment used for scientific research or investigation, including but not limited to manufactured cabinets, carts and racks.
SCONCE	is a wall mounted ornamental luminaire.
SEASONAL ENERGY EFFICIENCY RATIO (SEER)	is the total cooling output of an air conditioner in Btu 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.
SENIOR HOUSING	See <i>Nonresidential Functional Area or Type of Use</i> .
SERIES FAN POWERED TERMINAL UNIT	is a terminal unit that combines a VAV damper in series with a downstream fan which runs at all times that the terminal unit is supplying air to the space.
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.
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.
<u>SHOWER HEAD</u>	<u>is a fixture for directing the spray of water in a shower. A shower head may incorporate one or more sprays, nozzles or openings. All components that are supplied standard together and function from one inlet (i.e., after the mixing valve) form a single shower head.</u>

Term	Definition
<i>SIDE FINS</i>	are vertical shading elements mounted on either side of a glazed opening that can protect the glazing from lateral low angle sun penetration.
<i>SIGN</i>	<p>definitions include the following:</p> <p>Electronic Message Center (EMC) is a pixilated image producing electronically controlled sign formed by any light source. Bare lamps used to create linear lighting animation sequences through the use of chaser circuits, also known as “chaser lights” are not consider an EMC.</p> <p>Illuminated face is a side of a sign that has the message on it. For an exit sign it is the side that has the word “EXIT” on it.</p> <p>Sign, cabinet is an internally illuminated sign consisting of frame and face(s), with a continuous translucent message panel, also referred to as a panel sign</p> <p>Sign, channel letter is an internally illuminated sign with multiple components, each built in the shape of an individual three dimensional letters or symbol that are each independently illuminated, with a separate translucent panel over the light source for each element.</p> <p>Sign, double-faced is a sign with two parallel opposing faces.</p> <p>Sign, externally illuminated is any sign or a billboard that is lit by a light source that is external to the sign directed towards and shining on the face of the sign.</p> <p>Sign, internally illuminated is a sign that is illuminated by a light source that is contained inside the sign where the message area is luminous, including cabinet signs and channel letter signs.</p> <p>Sign, traffic is a sign for traffic direction, warning, and roadway identification.</p> <p>Sign, unfiltered is a sign where the viewer perceives the light source directly as the message, without any colored filter between the viewer and the light source, including neon, cold cathode, and LED signs.</p>
<i>SINGLE PACKAGE VERTICAL AIR CONDITIONER (SPVAC)</i>	<p>is a type of air-cooled small or large commercial package air-conditioning and heating equipment; factory assembled as a single package having its major components arranged vertically, which is an encased combination of cooling and optional heating components; is intended for exterior mounting on, adjacent interior to, or through an outside wall; and is powered by single or three-phase current. It may contain separate indoor grille(s), outdoor louvers, various ventilation options, indoor free air discharge, ductwork, wall plenum, or sleeve. Heating components may include electrical resistance, steam, hot water, gas, or no heat but may not include reverse cycle refrigeration as a heating means.</p>

Term	Definition
<i>SINGLE PACKAGE VERTICAL HEAT PUMP (SPVHP)</i>	is an SPVAC that utilizes reverse cycle refrigeration as its primary heat source, with secondary supplemental heating by means of electrical resistance, steam, hot water, or gas. [1]
<i>SINGLE ZONE</i>	is an HVAC system with a supply fan (and optionally a return fan) and heating and/or cooling heat exchangers (e.g. DX coil, chilled water coil, hot water coil, furnace, electric heater) that serves a single thermostatic zone. This system may or may not be constant volume.
<i>SITE SOLAR ENERGY</i>	is thermal, chemical, or electrical energy derived from direct conversion of incident solar radiation at the building site.
<i>SITE-BUILT FENESTRATION</i>	is fenestration designed to be field-glazed or field assembled units using specific factory cut or otherwise factory formed framing and glazing units that are manufactured with the intention of being assembled at the construction site and are provided with an NFRC label certificate for site-built fenestration. Examples of site-built fenestration include storefront systems, curtain walls, and atrium roof systems.
<i>SKYLIGHT</i>	is fenestration installed on a roof less than 60 degrees from the horizontal.
<i>SKYLIGHT AREA</i>	is the area of the rough opening for the skylight.
<i>SKYLIGHT TYPE</i>	is one of the following three types of skylights: glass mounted on a curb, glass not mounted on a curb or plastic (assumed to be mounted on a curb).
<i>SLAB-ON-GRADE</i>	is an exterior concrete floor in direct contact with the earth below the building.
<i>SMACNA</i>	is the Sheet Metal and Air-conditioning Contractors National Association.
<i>SMACNA RESIDENTIAL COMFORT SYSTEM INSTALLATION STANDARDS MANUAL</i>	is the Sheet Metal Contractors' National Association document entitled "Residential Comfort System Installation Standards Manual, Seventh Edition." (1998).
<i>SOCIAL SERVICES BUILDING</i>	is a space where public assistance and social services are provided to individuals or families.
<i>SOFT COAT</i>	is a low emissivity metallic coating applied to glass, which will be installed in a fenestration product through a sputter process where molecules of metals such as stainless steel or titanium are sputtered onto the surface of glass. Soft coats generally have lower emissivity than hard coats.
<i>SOLAR HEAT GAIN COEFFICIENT (SHGC)</i>	is the ratio of the solar heat gain entering the space through the fenestration area to the incident solar radiation. Solar heat gain includes directly transmitted solar heat and absorbed solar radiation, which is then reradiated, conducted, or convected into the space.

Term	Definition
SOLAR HEAT GAIN COEFFICIENT, CENTER OF GLAZING (SHGC _C)	is the SHGC for the center of glazing area.
SOLAR HEAT GAIN COEFFICIENT, TOTAL FENESTRATION PRODUCT (SHGC OR SHGC _T)	is the SHGC for the total fenestration product.
SOLAR REFLECTANCE	See <i>Reflectance</i> .
SOLAR REFLECTANCE INDEX (SRI)	is a measure of the roof's ability to reject solar heat which includes both reflectance and emittance.
<u>SOLAR SAVINGS FRACTION (SSF)</u>	<u>is the fraction of domestic hot water demand provided by a solar water-heating system.</u>
<u>SOLAR ZONE</u>	<u>is a section of the roof designated and reserved for the future installation of a solar electric or solar thermal system.</u>
SOUTH-FACING	See <i>Orientation</i> .
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	<p>is a system that <u>provides heating, ventilating, or cooling within or associated with conditioned spaces in a building, and</u> may consist of but not limited to <u>incorporate use of components such as chillers/compressors, distribution systems (air ducts, water piping, refrigerant piping), pumps, air handlers, unit, cooling and heating coils, air and/or -water cooled condensers, economizers, terminal units, and associated controls, and the air distribution system, which provide either collectively or individually heating, ventilating, or cooling within or associated with conditioned spaces in a building.</u></p> <p><u>New or Replacement Space Conditioning Systems for alterations to dwelling units include all of the system heating/cooling equipment (e.g. condensing unit(s) and cooling or heating coil(s) for split systems; or complete replacement of a package unit); and an entirely new or replacement duct system (see definition); and an entirely new or replacement air handler.</u></p>
SPACER, ALUMINUM	is a metal channel that is used either against the glass (sealed along the outside edge of the insulated glass unit), or separated from the glass by one or more beads of caulk, which is used to separate panes of glass in an insulated glass unit.
SPACER, INSULATING	is a non-metallic, relatively non-conductive material, usually of rubber compounds, that is used to separate panes of glass in an insulated glass unit.
SPACER, OTHER	is a wood, fiberglass, or composite material that is used as a spacer between panes of glass in insulated glass units.

Term	Definition
SPACER, SQUIGGLE	is a flexible material, usually butyl, formed around a thin corrugated aluminum strip that is used as a spacer in insulated glass units.
SPECIFIC HEAT	is the quantity of heat that must be added to a unit mass of a material to increase its temperature by one degree. Typical units are Btu/°F-lb.
SPLIT SYSTEM AIR CONDITIONER OR HEAT PUMP	is an air conditioner or heat pump that has physically separate condenser and air handling units that work together as a single cooling system.
STAIRS, ACTIVE / INACTIVE	See <i>Nonresidential Functional Area or Type of Use</i> .
STANDARD DESIGN	is a hypothetical building that is used to calculate the custom budget for nonresidential and residential buildings. A new building or addition alone complies with the standards if the predicted source energy use of the proposed design is the same or less than the annual budget for space conditioning and water heating of the Standard Design. The Standard Design is substantially similar to the Proposed Design, except it is in exact compliance with the prescriptive requirements and the mandatory measures.
<u>STANDARD DESIGN BUILDING</u>	<u>is derived from a proposed building using the modeling rules described in the Alternative Calculation Method Manual and by meeting the mandatory and prescriptive requirements in the Title 24 Building Energy Efficiency Standards. In order for a building to comply with the standards, the proposed building energy use must be less than or equal to the Standard Design Building energy use.</u>
STANDARDS	See <i>Building Energy Efficiency Standards</i> .
STANDBY LOSS, BTU/HR	is the heat lost per hour from the stored water above room temperature. It is one of the measures of efficiency of water heaters required for water heating energy calculations for some types of water heaters. This standby loss is expressed as Btu/hr.
STANDBY LOSS, PERCENT	is the ratio of heat lost per hour to the heat content of the stored water above room temperature. It is one of the measures of efficiency of water heaters required for water heating energy calculations for some types of water heaters. Standby loss is expressed as a percentage.
STEPPED DIMMING	See <i>Dimming, Stepped</i> .
STEPPED SWITCHING	is a lighting control method that varies the light output of a lighting system with the intent of maintaining approximately the relative uniformity of illumination by turning off alternate groups of lamps or luminaires.
STORAGE, COLD	is a storage area within a refrigerated warehouse where space temperatures are maintained at or above 32° F.

Term	Definition
STORAGE, COOL	is a storage area within a refrigerated warehouse where space temperatures are maintained between 32° F and 55° F.
STORAGE, FROZEN	is a storage area within a refrigerated warehouse where the space temperatures are maintained below 32° F.
SUBORDINATE OCCUPANCY	is any occupancy type, in mixed occupancy buildings, that is not the dominant occupancy. See <i>Dominant Occupancy, Mixed Occupancy</i> .
SUCTION LINE	is the refrigerant line that leads from the evaporator to the condenser in a split system air conditioner or heat pump. This line is insulated since it carries refrigerant at a low temperature.
SUPPORT AREA	See <i>Nonresidential Functional Area or Type of Use</i> .
SUSPENDED FILMS	are low-e coated plastic films stretched between the elements of the spacers between panes of glazing; acts as a reflector to slow the loss of heat from the interior to the exterior.
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 LIGHTING	is lighting that is designed specifically to illuminate a task location, and that is generally confined to the task location.
TDV ENERGY	See <i>Time Dependent Valuation (TDV) Energy</i> .
TEMPORARY LIGHTING	is a lighting installation with plug-in connections that does not persist beyond 60 consecutive days or more than 120 days per year.
TENANT LEASE SPACE	See <i>Nonresidential Functional Area or Type of Use</i> .
TENANT SPACE	is a portion of a building intended for occupancy by a single tenant.
THEATER, MOTION PICTURE	See <i>Nonresidential Functional Area or Type of Use</i> .
THEATER, PERFORMANCE	See <i>Nonresidential Functional Area or Type of Use</i> .
THERMAL BREAK WINDOW FRAME	is metal fenestration frames that are not solid metal from the inside to the outside, but are separated in the middle by a material, usually urethane, with a lower conductivity.
THERMAL CONDUCTIVITY	is the quantity of heat that will flow through a unit area of the material per hour when the temperature difference through the material is one degree.
THERMAL EMITTANCE	See <i>Emittance, Thermal</i> .
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 (hr. x ft. ² x °F)/Btu.

Term	Definition
THERMOSTATIC EXPANSION VALVE (TXV)	is a refrigerant metering valve, installed in an air conditioner or heat pump, which controls the flow of liquid refrigerant entering the evaporator in response to the superheat of the gas leaving it.
THROW DISTANCE	is the distance between the luminaire and the center of the plane lit by the luminaire on a display.
TIME DEPENDENT VALUATION (TDV) ENERGY	is the time varying energy caused to be used by the building to provide space conditioning and water heating and for specified buildings lighting. TDV energy accounts for the energy used at the building site and consumed in producing and in delivering energy to a site, including, but not limited to, power generation, transmission and distribution losses.
TITLE 24	is all of the building standards and associated administrative regulations published in Title 24 of the <i>California Code of Regulations</i> . The <i>Building Energy Efficiency Standards</i> are contained in Part 6. Part 1 contains the administrative regulations for the building standards.
<u>TOTAL HEAT OF REJECTION (THR)</u>	<u>is the heat absorbed at the evaporator plus the heat picked up in the suction line plus the heat added to the refrigerant in the compressor.</u>
TRAFFIC SIGN	See <i>Sign</i> .
<u>TRANSFER AIR</u>	<u>is air transferred from one room to another through openings in the room envelope, whether it is transferred intentionally or not. The driving force for transfer air is generally a small pressure differential between the rooms, although one or more fans may be used.</u>
<u>TRIM COMPRESSOR</u>	<u>is a compressor that is designated for part-load operation, handling the short term variable trim load of end uses, in addition to the fully loaded base compressors.</u>
<u>U-FACTOR, CENTER OF GLAZING (U_c)</u>	<u>is the U-factor for the center of glazing area</u>
U-FACTOR, <u>ENVELOPE</u>	is the overall coefficient of thermal transmittance of a construction assembly, in Btu/(hr. x ft. ² x °F), including air film resistance at both surfaces.
<u>U-FACTOR, TOTAL FENESTRATION PRODUCT (U_t)</u>	<u>is the U-factor for the total fenestration product.</u>
U-FACTOR, CENTER OF GLAZING (U-FACTOR_c)	is the U-Factor for the center of glazing area.
U-FACTOR, TOTAL FENESTRATION PRODUCT (U-FACTOR OR U-FACTOR_T)	is U-Factor for the total fenestration product.
UIMC	See <i>Unit Interior Mass Capacity</i> .
UL	is the Underwriters Laboratories.
UL 1574	is the Underwriters Laboratories document entitled "Track Lighting Systems.," 2000.
UL 1598	is the Underwriters Laboratories document entitled "Standard for Luminaires," 2000.

Term	Definition
<i>UL 181</i>	is the Underwriters Laboratories document entitled "Standard for Factory-Made Air Ducts and Air Connectors," 1996.
<i>UL 181A</i>	is the Underwriters Laboratories document entitled "Standard for Closure Systems for Use With Rigid Air Ducts and Air Connectors," 1994.
<i>UL 181B</i>	is the Underwriters Laboratories document entitled "Standard for Closure Systems for Use With Flexible Air Ducts and Air Connectors," 1995.
<i>UL 723</i>	is the Underwriters Laboratories document entitled "Standard for Test for Surface Burning Characteristics of Building Materials," 1996.
<i>UL 727</i>	is the Underwriters Laboratories document entitled "Standard for Oil-Fired Central Furnaces," 1994.
<i>UL 731</i>	is the Underwriters Laboratories document entitled "Standard for Oil-Fired Unit Heaters," 1995.
<i>UL 2108</i>	is the Underwriters Laboratories document entitled "Low Voltage Lighting Systems," 2008.
<i>UL DATA ACCEPTANCE PROGRAM (DAP)</i>	is an Underwriters Laboratory program that utilizes work conducted by a client as well as third-party test facilities in accordance with national and international accreditation criteria to facilitate the conduct of investigations of products. Among the types UL uses are Witnessed Test Data Program (WTDP) where UL witnesses the tests being conducted, Client Test Data Program (CTDP) which is where the client conducts the test and submits the data for UL review, and Third Party Test Data Program (TPTDP) where testing is conducted by another testing organization for clients and submitted to UL for review.
<i>UL®</i>	is the Underwriters Laboratories.
<i>UNCONDITIONED SPACE</i>	is enclosed space within a building that is not directly conditioned, or indirectly conditioned.
<i>UNFILTERED SIGN</i>	See <i>Sign</i> .
<i>UNIT INTERIOR MASS CAPACITY (UIMC)</i>	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.
<i>U-VALUE</i>	See <i>U-factor</i> .
<i>VACANCY SENSOR, LIGHTING</i>	is an occupant sensor for which the lights must be manually turned on but the sensor automatically turns the lights off soon after an area is vacated. The device also may be called a manual-on occupant sensor.
<i>VAPOR BARRIER</i>	is a material that has a permeance of one perm or less and that provides resistance to the transmission of water vapor.

Term	Definition
<u>VAPOR RETARDER CLASS</u>	<p>is a measure of the ability of a material or assembly to limit the amount of moisture that passes through the material or assembly. Vapor retarder class shall be defined using the desiccant method with Procedure A of ASTM E96 as follows:</p> <p>Class I: 0.1 perm or less</p> <p>Class II: 0.1 < perm < 1.0 perm</p> <p>Class III: 1.0 < perm < 10 perm</p>
VARIABLE AIR VOLUME (VAV) SYSTEM	is a space-conditioning system that maintains comfort levels by varying the volume of supply air to the zones served.
VEHICLE SERVICE STATION CANOPY	See <i>Outdoor Lighting</i> .
VENDING MACHINE	is a machine for vending and dispensing refrigerated or non-refrigerated food and beverages or general merchandise.
VENTILATION AIR	<p>is that portion of supply air which comes from outside plus any recirculated air that has been treated to maintain the desired quality of air within a designated space.</p> <p>See also <i>Outside Air</i>.</p>
VERTICAL GLAZING	See <i>Window</i> .
VERY VALUABLE MERCHANDISE	is rare or precious objects, including, but not limited to, jewelry, coins, small art objects, crystal, ceramics, or silver, the selling of which involves customer inspection of very fine detail from outside of a locked case.
VINYL WINDOW FRAME	is a fenestration frame constructed with a polyvinyl chloride (PVC) which has a lower conductivity than metal and a similar conductivity to wood.
VISIBLE TRANSMITTANCE (VT)	is the ratio (expressed as a decimal) of visible light that is transmitted through a glazing to the light that strikes the material.
VISIBLE TRANSMITTANCE, CENTER OF GLAZING (VT _c)	is the VT for the center of glazing area.
VISIBLE TRANSMITTANCE, TOTAL FENESTRATION PRODUCT (VT OR VT _T)	is the VT for the total fenestration product.
VOCATIONAL ROOM	See <i>Nonresidential Functional Area or Type of Use</i> .
WAITING AREA	See <i>Nonresidential Functional Area or Type of Use</i> .
WALL TYPE	is a type of wall assembly having a specific heat capacity, framing type, and U-factor.

Term	Definition
<u>WATER BALANCE IN EVAPORATIVE COOLING TOWERS</u>	<p>The water balance in cooling towers is:</p> <p>$M = E + B + D$, where:</p> <p><u>M = makeup water (from the mains water supply)</u></p> <p><u>E = losses due to evaporation</u></p> <p><u>B = losses due to blowdown</u></p> <p><u>D = drift losses</u></p>
WEATHERSTRIPPING	<p>is a specially designed strip, seal or gasket attached to doors and windows to prevent infiltration and exfiltration through cracks around the openings. Weatherstripping is one of the mandatory requirements for all new residential construction. See <i>Infiltration, Exfiltration</i>.</p>
WEIGHTED AVERAGING	<p>is an arithmetic technique for determining an average of differing values for the members of a set by weighting each value by the extent to which the value occurs. In some cases when two or more types of a building feature, material or construction assembly occur in a building, a weighted average of the different types may be sufficiently accurate to represent the energy impact of each type considered separately.</p>
WEST-FACING	See <i>Orientation</i> .
WHOLESALE SHOWROOM	See <i>Nonresidential Functional Area or Type of Use</i> .
WINDOW	is fenestration 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 TYPE	is a window assembly having a specific solar heat gain coefficient, relative solar heat gain, and U-factor.
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.
WOOD STOVE	See <i>Wood Heater</i> .
ZONAL CONTROL	<p>is the practice of dividing a residence into separately controlled HVAC zones. This may be done by installing multiple HVAC systems that condition a specific part of the building, or by installing one HVAC system with a specially designed distribution system that permits zonal control. The Energy Commission has approved an alternative calculation method for analyzing the energy impact of zonally controlled space heating and cooling systems. To qualify for compliance credit for zonal control, specific eligibility criteria specified in the Residential ACM Manual must be met.</p>

Term	Definition
<i>ZONE, CRITICAL</i>	is a zone serving a process where reset of the zone temperature setpoint during a demand shed event might disrupt the process, including but not limited to data centers, telecom and private branch exchange (PBX) rooms, and laboratories.
<i>ZONE, NON-CRITICAL</i>	is a zone that is not a critical zone.
<i>ZONE, SPACE-CONDITIONING</i>	is a space or group of spaces within a building with sufficiently similar comfort conditioning requirements so that comfort conditions, as specified in §140.4(b)3 or §150.0(h), as applicable, can be maintained throughout the zone by a single controlling device.

Joint Appendix JA2

Appendix JA2 – Reference Weather/Climate Data

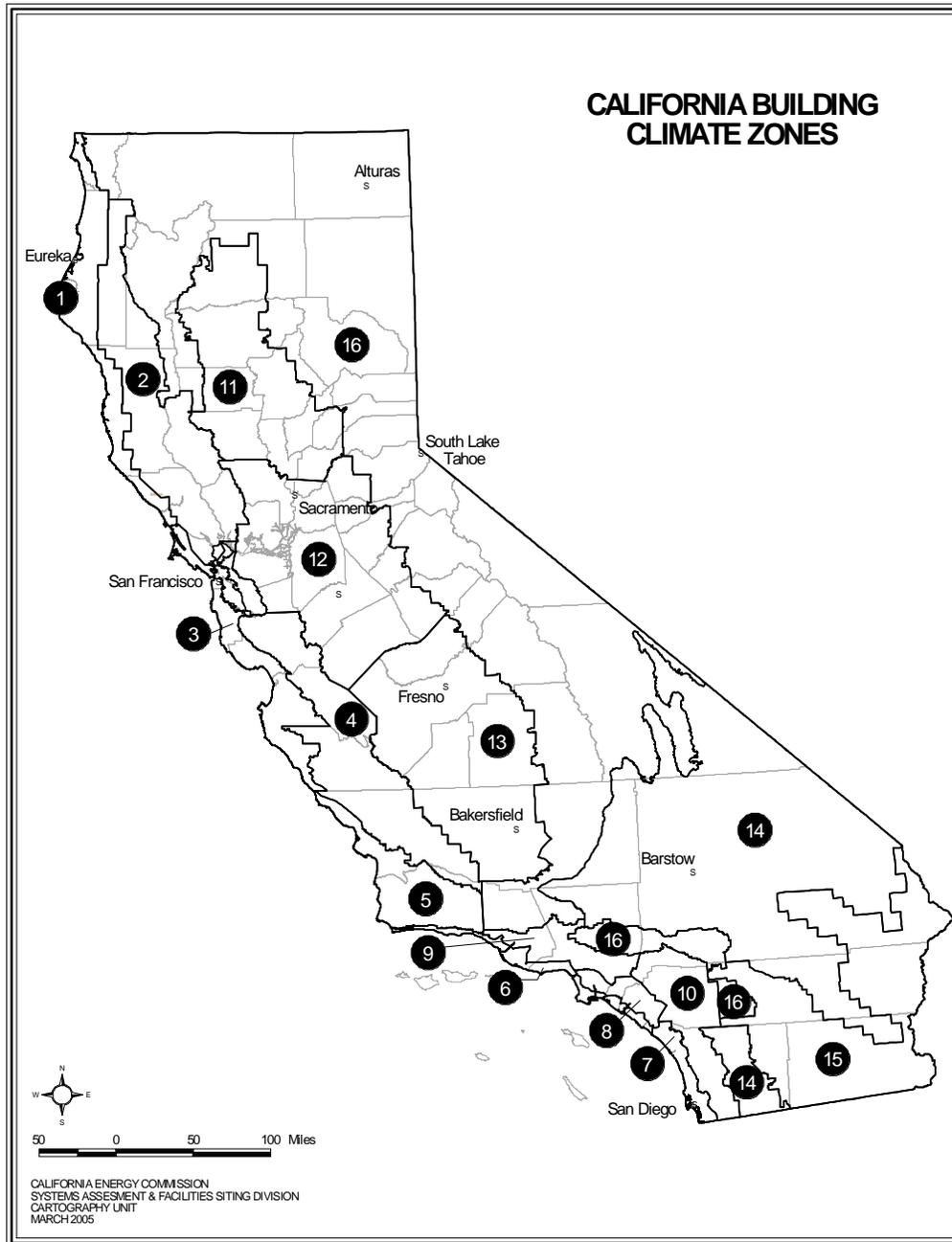


Figure2-1 – Climate Zone Map

JA2.1 Weather Data - General

All energy calculations used for compliance with the Standards must use the Commission's sixteen (16) official hourly weather files or modifications of these files adapted for the design day conditions in Table 2-3. The modified weather files make the HVAC sizing and energy calculations more realistic for energy compliance simulations. These files are available in electronic form from the Commission in the ~~WYEC2 (Weather Year for Energy Calculations)~~ format and in DOE 2.1E packed weather data format. [CSV \(Comma Delimited File\) format](#), [TMY2 \(Typical Meteorological Year\) -format](#) and [EPW \(EnergyPlus\) format](#).

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Each weather file contains data on a variety of ambient conditions such as:

- Dry bulb temperature
- Wet bulb temperature
- Wind speed and direction
- Direct solar radiation
- Diffuse radiation

Table 2-1 –California Standard Climate Zone Summary

Note: The alternative weather files modified for local design conditions use the specific latitude, longitude and elevation of the selected city.

Climate Zone	City	Latitude	Longitude	Elevation (ft)
1	Arcata	41.00.8	124.12	43203
2	Santa Rosa	38.54	122.87	164125
3	Oakland	37.7	122.2	6
4	Sunnyvale San Jose-Reid	37.34	122.4121.8	97135
5	Santa Maria	34.9	120.4	236253
6	Los Angeles AP Torrance	33.89	118.35	9788
7	San Diego Lindbergh	32.7	117.2	13
8	El Toro Fullerton	33.96	117.7118.0	38395
9	Burbank Glendale	34.2	118.34	655741
10	Riverside	33.9	117.42	1543840
11	Red Bluff	40.12	122.2	342348
12	Sacramento	38.5	121.5	1716
13	Fresno	36.8	119.7	328335
14	China Lake Palmdale	35.734.6	117.7118.0	22932523
15	El Centro Palm Springs-Intl	32.833.8	115.6116.5	30475
16	Mt. Shasta Blue Canyon	41.339.2	122.3120.7	35445279

JA2.1.1 Counties and Cities with Climate Zone Designations

The following pages are a listing of California counties and cities, ZIP codes, and counties with a climate zone designation for each. This information represents an abridged version of the Commission publication *California Climate Zone Descriptions* which contains detailed survey definitions of the 16 climate zones.

Table 2-2 – Counties and Cities with Climate Zone Designations

CITY	ZIP CODE	COUNTY	CZ	Alameda	94502	Alameda	3	
A				Alamo	94507	Contra Costa	12	
				Albany	94706	Alameda	3	
				Alderpoint	95511	Humboldt	2	
	Acampo	95220	San Joaquin	12	Alhambra	91801	Los Angeles	9
	Acton	93510	Los Angeles	14	Alhambra	91803	Los Angeles	9
	Adelanto	92301	San Bernardino	14	Aliso Viejo	92656	Orange	6
	Adin	96006	Modoc	16	CITY	ZIP CODE	COUNTY	CZ
	Agoura	91301	Los Angeles	9	Alleghany	95910	Sierra	16
	Agoura	91301	Ventura	9	Alpine	91901	San Diego	10
	Aguanga	92536	Riverside	15	Alta	95701	Placer	16
Ahwahnee	93601	Madera	13	Altadena	91001	Los Angeles	16	
Ahwahnee	93601	Mariposa	13	Alturus	96101	Modoc	16	
Alameda	94501	Alameda	3	Amboy	92304	San Bernardino	15	
				American Canyon	94503	Napa	2	

American Canyon	94503	Solano	2	Auberry	93602	Madera	16
Anaheim	92801	Orange	8	Auburn	95602	Nevada	11
Anaheim	92802	Orange	8	Auburn	95602	Placer	11
Anaheim	92804	Orange	8	Auburn	95603	Placer	11
Anaheim	92805	Orange	8	Avenal	93204	Kings	13
Anaheim	92806	Orange	8	Azusa	91702	Los Angeles	9
Anaheim	92807	Orange	8				
Anaheim	92808	Orange	8	B			
Anderson	96007	Shasta	11				
Anderson	96007	Tehama	11	Bakersfield	93301	Kern	13
Angels Camp	95222	Calaveras	12	Bakersfield	93304	Kern	13
Angels Camp	95222	Tuolumne	12	Bakersfield	93305	Kern	13
Angelus Oaks	92305	San Bernardino	15	Bakersfield	93306	Kern	13
CITY	ZIP CODE	COUNTY	CZ	Bakersfield	93307	Kern	13
Angwin	94508	Napa	2	Bakersfield	93308	Kern	13
Annapolis	95412	Sonoma	1	Bakersfield	93309	Kern	13
Antioch	94509	Contra Costa	12	Bakersfield	93311	Kern	13
Antioch	94531	Contra Costa	12	Bakersfield	93312	Kern	13
Anza	92539	Riverside	16	Bakersfield	93313	Kern	13
Apple Valley	92307	San Bernardino	14	Bakersfield	93314	Kern	13
Apple Valley	92308	San Bernardino	14	Balboa	92662	Orange	6
Applegate	95703	Placer	11	Baldwin Park	91706	Los Angeles	9
Aptos	95003	Santa Cruz	3	Ballico	95303	Merced	12
Arcadia	91006	Los Angeles	9	Bangor	95914	Butte	11
Arcadia	91007	Los Angeles	9	Bangor	95914	Yuba	11
Arcata	95521	Humboldt	1	Banning	92220	Riverside	15
Aretsia	90701	Los Angeles	8	Barstow	92311	San Bernardino	14
Armona	93202	Kings	13	Bass Lake	93604	Madera	16
Arnold	95223	Alpine	16	Bayside	95524	Humboldt	1
Arnold	95223	Calaveras	16	CITY	ZIP CODE	COUNTY	CZ
Aromas	95004	Monterey	4	Beale AFB	95903	Yuba	11
Aromas	95004	San Benito	4	Beaumont	92223	Riverside	10
Arroyo Grande	93420	San Luis Obispo	5	Belden	95915	Plumas	16
Arvin	93203	Kern	13	Bell	90201	Los Angeles	8
Atascadero	93422	San Luis Obispo	4	Bella Vista	96008	Shasta	11
Atherton	94027	San Mateo	3	Bellflower	90706	Los Angeles	8
Atwater	95301	Merced	12	Belmont	94002	San Mateo	3
Auberry	93602	Fresno	16				

<u>Belvedere</u>				<u>Bodfish</u>	<u>93205</u>	<u>Kern</u>	<u>16</u>
<u>Tiburon</u>	<u>94920</u>	<u>Marin</u>	<u>3</u>	<u>Bolinas</u>	<u>94924</u>	<u>Marin</u>	<u>3</u>
<u>Ben Lomond</u>	<u>95005</u>	<u>Santa Cruz</u>	<u>3</u>	<u>Bonita</u>	<u>91902</u>	<u>San Diego</u>	<u>7</u>
<u>Benicia</u>	<u>94510</u>	<u>Solano</u>	<u>12</u>	<u>Bonsall</u>	<u>92003</u>	<u>San Diego</u>	<u>10</u>
<u>Berkeley</u>	<u>94702</u>	<u>Alameda</u>	<u>3</u>	<u>Boonville</u>	<u>95415</u>	<u>Mendocino</u>	<u>2</u>
<u>Berkeley</u>	<u>94703</u>	<u>Alameda</u>	<u>3</u>	<u>Boron</u>	<u>93516</u>	<u>Kern</u>	<u>14</u>
<u>Berkeley</u>	<u>94704</u>	<u>Alameda</u>	<u>3</u>	<u>Borrego Springs</u>	<u>92004</u>	<u>San Diego</u>	<u>15</u>
<u>Berkeley</u>	<u>94705</u>	<u>Alameda</u>	<u>3</u>	<u>Boulder Creek</u>	<u>95006</u>	<u>San Mateo</u>	<u>3</u>
<u>Berkeley</u>	<u>94707</u>	<u>Alameda</u>	<u>3</u>	<u>CITY</u>	<u>ZIP CODE</u>	<u>COUNTY</u>	<u>CZ</u>
<u>Berkeley</u>	<u>94707</u>	<u>Contra Costa</u>	<u>3</u>	<u>Boulder Creek</u>	<u>95006</u>	<u>Santa Cruz</u>	<u>3</u>
<u>Berkeley</u>	<u>94708</u>	<u>Alameda</u>	<u>3</u>	<u>Boulevard</u>	<u>91905</u>	<u>San Diego</u>	<u>14</u>
<u>Berkeley</u>	<u>94708</u>	<u>Contra Costa</u>	<u>3</u>	<u>Bradley</u>	<u>93426</u>	<u>Monterey</u>	<u>4</u>
<u>Berkeley</u>	<u>94709</u>	<u>Alameda</u>	<u>3</u>	<u>Bradley</u>	<u>93426</u>	<u>San Luis Obispo</u>	<u>4</u>
<u>Berkeley</u>	<u>94710</u>	<u>Alameda</u>	<u>3</u>	<u>Branscomb</u>	<u>95417</u>	<u>Mendocino</u>	<u>1</u>
<u>Berkeley</u>	<u>94720</u>	<u>Alameda</u>	<u>3</u>	<u>Brawley</u>	<u>92227</u>	<u>Imperial</u>	<u>15</u>
<u>Berry Creek</u>	<u>95916</u>	<u>Butte</u>	<u>16</u>	<u>Brea</u>	<u>92821</u>	<u>Orange</u>	<u>8</u>
<u>Beverly Hills</u>	<u>90210</u>	<u>Los Angeles</u>	<u>9</u>	<u>Brea</u>	<u>92823</u>	<u>Orange</u>	<u>8</u>
<u>Beverly Hills</u>	<u>90211</u>	<u>Los Angeles</u>	<u>9</u>	<u>Brentwood</u>	<u>94513</u>	<u>Contra Costa</u>	<u>12</u>
<u>Beverly Hills</u>	<u>90212</u>	<u>Los Angeles</u>	<u>9</u>	<u>Bridgeport</u>	<u>93517</u>	<u>Mono</u>	<u>16</u>
<u>Big Bar</u>	<u>96010</u>	<u>Trinity</u>	<u>16</u>	<u>Bridgeville</u>	<u>95526</u>	<u>Humboldt</u>	<u>2</u>
<u>Big Bear City</u>	<u>92314</u>	<u>San Bernardino</u>	<u>16</u>	<u>Bridgeville</u>	<u>95526</u>	<u>Trinity</u>	<u>2</u>
<u>Big Bear Lake</u>	<u>92315</u>	<u>San Bernardino</u>	<u>16</u>	<u>Brisbane</u>	<u>94005</u>	<u>San Mateo</u>	<u>3</u>
<u>Big Pine</u>	<u>93513</u>	<u>Inyo</u>	<u>16</u>	<u>Brooks</u>	<u>95606</u>	<u>Yolo</u>	<u>12</u>
<u>Big River</u>	<u>92242</u>	<u>San Bernardino</u>	<u>15</u>	<u>Browns Valley</u>	<u>95918</u>	<u>Yuba</u>	<u>11</u>
<u>Big Sur</u>	<u>93920</u>	<u>Monterey</u>	<u>3</u>	<u>Brownsville</u>	<u>95919</u>	<u>Yuba</u>	<u>11</u>
<u>Biggs</u>	<u>95917</u>	<u>Butte</u>	<u>11</u>	<u>Buellton</u>	<u>93427</u>	<u>Santa Barbara</u>	<u>5</u>
<u>Birds Landing</u>	<u>94512</u>	<u>Solano</u>	<u>12</u>	<u>Buena Park</u>	<u>90620</u>	<u>Orange</u>	<u>8</u>
<u>Bishop</u>	<u>93512</u>	<u>Mono</u>	<u>16</u>	<u>Buena Park</u>	<u>90621</u>	<u>Orange</u>	<u>8</u>
<u>Bishop</u>	<u>93514</u>	<u>Inyo</u>	<u>16</u>	<u>Burbank</u>	<u>91501</u>	<u>Los Angeles</u>	<u>9</u>
<u>Bishop</u>	<u>93514</u>	<u>Mono</u>	<u>16</u>	<u>Burbank</u>	<u>91502</u>	<u>Los Angeles</u>	<u>9</u>
<u>Blairsden</u>	<u>96103</u>	<u>Plumas</u>	<u>16</u>	<u>Burbank</u>	<u>91504</u>	<u>Los Angeles</u>	<u>9</u>
<u>Blocksburg</u>	<u>95514</u>	<u>Humboldt</u>	<u>2</u>	<u>Burbank</u>	<u>91505</u>	<u>Los Angeles</u>	<u>9</u>
<u>Bloomington</u>	<u>92316</u>	<u>San Bernardino</u>	<u>10</u>	<u>Burbank</u>	<u>91506</u>	<u>Los Angeles</u>	<u>9</u>
<u>Blue Jay</u>	<u>92317</u>	<u>San Bernardino</u>	<u>16</u>	<u>Burbank</u>	<u>91521</u>	<u>Los Angeles</u>	<u>9</u>
<u>Blue Lake</u>	<u>95525</u>	<u>Humboldt</u>	<u>1</u>	<u>Burbank</u>	<u>91522</u>	<u>Los Angeles</u>	<u>9</u>
<u>Blythe</u>	<u>92225</u>	<u>Riverside</u>	<u>15</u>	<u>Burbank</u>	<u>91523</u>	<u>Los Angeles</u>	<u>9</u>
<u>Bodega</u>	<u>94922</u>	<u>Sonoma</u>	<u>1</u>	<u>Burlingame</u>	<u>94010</u>	<u>San Mateo</u>	<u>3</u>
<u>Bodega Bay</u>	<u>94923</u>	<u>Sonoma</u>	<u>1</u>	<u>Burney</u>	<u>96013</u>	<u>Shasta</u>	<u>16</u>

Burney	96013	Siskiyou	16	Canyon Country	91390	Los Angeles	16
Burnt Ranch	95527	Trinity	16	Canyondam	95923	Plumas	16
Butte City	95920	Glenn	11	Capay	95607	Yolo	12
Buttonwillow	93206	Kern	13	Capistrano Beach	92624	Orange	6
Byron	94514	Alameda	12	Capitola	95010	Santa Cruz	3
Byron	94514	Contra Costa	12	Cardiff by the Sea	92007	San Diego	7
				Carlotta	95528	Humboldt	1
				Carlsbad	92008	San Diego	7
				Carlsbad	92009	San Diego	7
				Carlsbad	92010	San Diego	7
				Carlsbad	92011	San Diego	7
				Carmel	93923	Monterey	3
				Carmel Valley	93924	Monterey	3
				Carmichael	95608	Sacramento	12
				Carnelian Bay	96140	Placer	16
				Carpinteria	93013	Santa Barbara	6
				Carpinteria	93013	Ventura	6
				Carson	90745	Los Angeles	6
				Carson	90746	Los Angeles	8
				Carson	90747	Los Angeles	8
				Caruthers	93609	Fresno	13
				Casmalia	93429	Santa Barbara	5
				Caspar	95420	Mendocino	1
				Cassel	96016	Shasta	16
				Castaic	91384	Los Angeles	9
				Castro Valley	94546	Alameda	3
				Castro Valley	94552	Alameda	3
				Castroville	95012	Monterey	3
				Cathedral City	92234	Riverside	15
				Catheys Valley	95306	Mariposa	12
				Cayucos	93430	San Luis Obispo	5
				Cazadero	95421	Sonoma	1
				Cedar Glen	92321	San Bernardino	16
				Cedarpines Park	92322	San Bernardino	16
				Cedarville	96104	Modoc	16
				Ceres	95307	Stanislaus	12
				Cerritos	90703	Los Angeles	8
				Challenge	95925	Yuba	16
C							
Cabazon	92230	Riverside	15				
Calexico	92231	Imperial	15				
Caliente	93518	Kern	16				
California City	93505	Kern	14				
California City	93505	San Bernardino	14				
California Hot Springs	93207	Tulare	13				
Calimesa	92320	Riverside	10				
Calipatria	92233	Imperial	15				
Calistoga	94515	Napa	2				
Calistoga	94515	Sonoma	2				
Callahan	96014	Siskiyou	16				
Callahan	96014	Trinity	16				
Calpine	96124	Sierra	16				
Camarillo	93010	Ventura	6				
CITY	ZIP CODE	COUNTY	CZ				
Camarillo	93012	Ventura	6				
Cambria	93428	San Luis Obispo	5				
Camino	95709	El Dorado	12				
Camp Pendleton North	92055	San Diego	7				
Campbell	95008	Santa Clara	4				
Campo	91906	San Diego	14				
Camptonville	95922	Sierra	16				
Camptonville	95922	Yuba	16				
Canby	96015	Modoc	16				
Cantua Creek	93608	Fresno	13				
Canyon Country	91351	Los Angeles	9				
Canyon Country	91387	Los Angeles	9				

Chatsworth	91311	Los Angeles	9	Coalinga	93210	Fresno	13
Chatsworth	91311	Ventura	9	Coarsegold	93614	Madera	13
CITY	ZIP CODE	COUNTY	CZ	Coleville	96107	Mono	16
Chester	96020	Plumas	16	Colfax	95713	Placer	11
Chico	95926	Butte	11	College City	95912	Colusa	11
Chico	95928	Butte	11	Colton	92324	Riverside	10
Chico	95928	Glenn	11	Colton	92324	San Bernardino	10
Chico	95973	Butte	11	Columbia	95310	Tuolumne	12
Chico	95973	Tehama	11	Colusa	95932	Colusa	11
Chilcoot	96105	Plumas	16	Comptche	95427	Mendocino	1
Chinese Camp	95309	Tuolumne	12	Compton	90220	Los Angeles	8
Chino	91708	San Bernardino	10	Compton	90221	Los Angeles	8
Chino	91710	Los Angeles	10	Compton	90222	Los Angeles	8
Chino	91710	San Bernardino	10	Concord	94518	Contra Costa	12
Chino Hills	91709	San Bernardino	10	Concord	94519	Contra Costa	12
Chowchilla	93610	Madera	13	Concord	94520	Contra Costa	12
Chowchilla	93610	Merced	13	Concord	94521	Contra Costa	12
Chualar	93925	Monterey	3	CITY	ZIP CODE	COUNTY	CZ
Chula Vista	91910	San Diego	7	Cool	95614	El Dorado	12
Chula Vista	91911	San Diego	7	Cool	95614	Placer	12
Chula Vista	91913	San Diego	7	Cooperopolis	95228	Calaveras	12
Chula Vista	91914	San Diego	10	Cooperopolis	95228	Tuolumne	12
Chula Vista	91915	San Diego	7	Corcoran	93212	Kings	13
Chula Vista	91932	San Diego	7	Corcoran	93212	Tulare	13
Cilo	96106	Plumas	16	Corning	96021	Tehama	11
Citrus Heights	95610	Sacramento	12	Corona	92879	Riverside	10
Citrus Heights	95621	Sacramento	12	Corona	92880	Riverside	10
Claremont	91711	Los Angeles	9	Corona	92880	San Bernardino	10
Clarksburg	95612	Yolo	12	Corona	92881	Riverside	10
Clayton	94517	Contra Costa	12	Corona	92882	Riverside	10
Clearlake	95422	Lake	2	Corona	92883	Riverside	10
Clearlake Oaks	95423	Colusa	2	Corona dl Mar	92625	Orange	6
Clearlake Oaks	95423	Lake	2	Coronado	92118	San Diego	7
Cloverdale	95425	Sonoma	2	Corte Madera	94925	Marin	3
Clovis	93611	Fresno	13	Costa Mesa	92626	Orange	6
Clovis	93612	Fresno	13	Costa Mesa	92627	Orange	6
Clovis	93619	Fresno	13	Cotati	94931	Sonoma	2
Coachella	92236	Riverside	15	Coto De Caza	92679	Orange	8

Cottonwood	96022	Shasta	11	Davis	95618	Solano	12
Cottonwood	96022	Tehama	11	Davis	95618	Yolo	12
Coulterville	95311	Mariposa	12	Davis Creek	96108	Modoc	16
Coulterville	95311	Tuolumne	12	Death Valley	92328	Inyo	14
Courtland	95615	Sacramento	12	Deer Park	94576	Napa	2
Courtland	95615	Yolo	12	Del Mar	92014	San Diego	7
Covelo	95428	Mendocino	2	Del Rey	93616	Fresno	13
Covelo	95428	Tehama	2	Delano	93215	Kern	13
Covina	91722	Los Angeles	9	Delano	93215	Tulare	13
Covina	91723	Los Angeles	9	Delhi	95315	Merced	12
Covina	91724	Los Angeles	9	Denair	95316	Merced	12
Crescent City	95531	Del Norte	1	Denair	95316	Stanislaus	12
Crescent Mills	95934	Plumas	16	Descanso	91916	San Diego	14
Crestline	92325	San Bernardino	16	Desert Hot Springs	92240	Riverside	15
Creston	93432	San Luis Obispo	4	Desert Hot Springs	92241	Riverside	15
Crockett	94525	Contra Costa	12	Diablo	94528	Contra Costa	12
Crows Landing	95313	Stanislaus	12	Diamond Bar	91765	Los Angeles	9
Culver City	90230	Los Angeles	8	Diamond Springs	95619	El Dorado	12
Culver City	90232	Los Angeles	8	Dillon Beach	94929	Marin	3
Cupertino	95014	Santa Clara	4	Dinuba	93618	Fresno	13
Cutler	93615	Tulare	13	Dinuba	93618	Tulare	13
Cypress	90630	Orange	8	Discovery Bay	94505	Contra Costa	12
D				Dixon	95620	Solano	12
				Dixon	95620	Yolo	12
Daggett	92327	San Bernardino	14	Dobbins	95935	Yuba	11
Daly City	94014	San Francisco	3	Dorris	96023	Siskiyou	16
Daly City	94014	San Mateo	3	Dos Palos	93620	Fresno	12
Daly City	94015	San Francisco	3	Dos Palos	93620	Madera	12
Daly City	94015	San Mateo	3	Dos Palos	93620	Merced	12
Dan Point	92629	Orange	6	Dos Rios	95429	Mendocino	2
Danville	94506	Contra Costa	12	Douglas City	96024	Trinity	16
Danville	94526	Contra Costa	12	Downey	90240	Los Angeles	8
CITY	ZIP CODE	COUNTY	CZ	Downey	90241	Los Angeles	8
Davenport	95017	Santa Cruz	3	Downey	90242	Los Angeles	8
Davis	95616	Solano	12	Downieville	95936	Sierra	16
Davis	95616	Yolo	12	Doyle	96109	Lassen	16

Duarte	91008	Los Angeles	16	Elk Grove	95624	Sacramento	12
Duarte	91010	Los Angeles	9	Elk Grove	95757	Sacramento	12
Dublin	94568	Alameda	12	Elk Grove	95758	Sacramento	12
Dublin	94568	Contra Costa	12	Elverta	95626	Placer	12
Dulzura	91917	San Diego	10	Elverta	95626	Sacramento	12
Dunlap	93621	Fresno	13	Elverta	95626	Sutter	12
Dunnigan	95937	Yolo	12	Emeryville	94608	Alameda	3
Dunsmuir	96025	Shasta	16	Emigrant Gap	95715	Placer	16
Dunsmuir	96025	Siskiyou	16	Encinitas	92024	San Diego	7
Durham	95938	Butte	11	Escalon	95320	San Joaquin	12
Dutch Flat	95714	Placer	16	Escondido	92025	San Diego	10
				Escondido	92026	San Diego	10
CITY	ZIP CODE	COUNTY	CZ	Escondido	92027	San Diego	10
				Escondido	92029	San Diego	10
E				Esparto	95627	Yolo	12
				Essex	92332	San Bernardino	14
Eagle Mountain	92239	Riverside	15	Etna	96027	Siskiyou	16
Earlimart	93219	Tulare	13	Eureka	95501	Humboldt	1
Echo Lake	95721	El Dorado	16	Eureka	95503	Humboldt	1
Edwards AFB	93524	Kern	14	Exeter	93221	Tulare	13
Edwards AFB	93524	San Bernardino	14				
El Cajon	92019	San Diego	10	E			
El Cajon	92020	San Diego	7				
El Cajon	92021	San Diego	10	Fair Oaks	95628	Sacramento	12
El Centro	92243	Imperial	15	Fairfax	94930	Marin	2
El Cerrito	94530	Contra Costa	3	Fairfield	94533	Solano	12
El Dorado	95623	El Dorado	12	Fairfield	94534	Solano	12
El Dorado Hills	95762	El Dorado	12	Fairfield	94535	Solano	12
El Dorado Hills	95762	Sacramento	12	CITY	ZIP CODE	COUNTY	CZ
El Monte	91731	Los Angeles	9	Fall River Mills	96028	Shasta	16
El Monte	91732	Los Angeles	9	Fallbrook	92028	Riverside	10
El Nido	95317	Merced	12	Fallbrook	92028	San Diego	10
El Portal	95318	Mariposa	16	Farmersville	93223	Tulare	13
El Segundo	90245	Los Angeles	6	Farmington	95230	Calaveras	12
El Sobrante	94803	Contra Costa	3	Farmington	95230	San Joaquin	12
El Toro	92630	Orange	8	Farmington	95230	Stanislaus	12
Elk	95432	Mendocino	1	Farmington	95230	Stanislaus	12
Elk Creek	95939	Glenn	11	Fellows	93224	Kern	13

Felton	95018	Santa Cruz	3	Fremont	94555	Alameda	3
Ferndale	95536	Humboldt	1	French Camp	95231	San Joaquin	12
Fiddletown	95629	Amador	12	French Gulch	96033	Shasta	11
Fiddletown	95629	El Dorado	12	Fresno	93650	Fresno	13
Fillmore	93015	Ventura	9	Fresno	93701	Fresno	13
Firebaugh	93622	Fresno	13	Fresno	93702	Fresno	13
Firebaugh	93622	Madera	13	CITY	ZIP CODE	COUNTY	CZ
Firebaugh	93622	Merced	13	Fresno	93703	Fresno	13
Fish Camp	93623	Mariposa	16	Fresno	93704	Fresno	13
Floriston	96111	Nevada	16	Fresno	93705	Fresno	13
Folsom	95630	Sacramento	12	Fresno	93706	Fresno	13
Fontana	92335	San Bernardino	10	Fresno	93710	Fresno	13
Fontana	92336	San Bernardino	10	Fresno	93711	Fresno	13
Fontana	92337	San Bernardino	10	Fresno	93720	Fresno	13
Foothill Ranch	92610	Orange	8	Fresno	93720	Madera	13
Forbestown	95941	Butte	11	Fresno	93721	Fresno	13
Forbestown	95941	Yuba	11	Fresno	93722	Fresno	13
Forest Falls	92339	San Bernardino	16	Fresno	93723	Fresno	13
Forest Ranch	95942	Butte	16	Fresno	93725	Fresno	13
Forest Ranch	95942	Tehama	16	Fresno	93726	Fresno	13
Foresthill	95631	Placer	16	Fresno	93727	Fresno	13
Forestville	95436	Sonoma	2	Fresno	93728	Fresno	13
Forks of Salmon	96031	Siskiyou	16	Fresno	93730	Fresno	13
Forks of Salmon	96031	Trinity	16	Fresno	93730	Madera	13
Fort Bidwell	96112	Modoc	16	Fresno	93741	Fresno	13
Fort Bragg	95437	Mendocino	1	Friant	93626	Fresno	13
Fort Irwin	92310	San Bernardino	14	Friant	93626	Madera	13
Fort Jones	96032	Siskiyou	16	Fullerton	92831	Orange	8
Fortuna	95540	Humboldt	1	Fullerton	92832	Orange	8
Fountain Valley	92708	Orange	6	Fullerton	92833	Orange	8
Fowler	93625	Fresno	13	Fullerton	92835	Orange	8
Frazier Park	93225	Kern	16				
Frazier Park	93225	Ventura	16	G			
Freedom	95019	Santa Cruz	3				
Fremont	94536	Alameda	3	Galt	95632	Sacramento	12
Fremont	94538	Alameda	3	Galt	95632	San Joaquin	12
Fremont	94539	Alameda	3	Garberville	95542	Humboldt	2
Fremont	94539	Santa Clara	3				

Garberville	95542	Trinity	2	Granite Bay	95746	Placer	11
Garberville	95554	Humboldt	2	Grass Valley	95945	Nevada	11
Garden Grove	92840	Orange	8	Grass Valley	95949	Nevada	11
Garden Grove	92841	Orange	8	Graton	95444	Sonoma	2
Garden Grove	92843	Orange	8	Greenfield	93927	Monterey	4
Garden Grove	92844	Orange	8	Greenville	95947	Plumas	16
Garden Grove	92845	Orange	8	Greenwood	95635	El Dorado	12
Garden Valley	95633	El Dorado	12	Grenada	96038	Siskiyou	16
Gardena	90247	Los Angeles	8	Gridley	95948	Butte	11
Gardena	90248	Los Angeles	8	Gridley	95948	Sutter	11
Gardena	90249	Los Angeles	8	Grizzly Flats	95636	El Dorado	16
Gasquet	95543	Del Norte	16	Groveland	95321	Mariposa	16
Gazelle	96034	Siskiyou	16	Groveland	95321	Tuolumne	16
Georgetown	95634	El Dorado	12	Grover Beach	93433	San Luis Obispo	5
Gerber	96035	Tehama	11	Guadalupe	93434	Santa Barbara	5
Geyserville	95441	Sonoma	2	Gualala	95445	Mendocino	1
Gilroy	95020	Santa Clara	4	Guerneville	95446	Sonoma	2
Glen Ellen	95442	Sonoma	2	Guinda	95637	Yolo	12
Glencoe	95232	Calaveras	12	Gustin	95322	Merced	12
Glendale	91201	Los Angeles	9	Gustin	95322	Stanislaus	12
Glendale	91202	Los Angeles	9				
Glendale	91203	Los Angeles	9				
Glendale	91204	Los Angeles	9				
CITY	ZIP CODE	COUNTY	CZ				
Glendale	91205	Los Angeles	9	Hacienda Heights	91745	Los Angeles	9
Glendale	91206	Los Angeles	9	Half Moon Bay	94019	San Mateo	3
Glendale	91207	Los Angeles	9	Hamilton	95951	Glenn	11
Glendale	91208	Los Angeles	9	Hanford	93230	Kings	13
Glendora	91740	Los Angeles	9	Happy Camp	96039	Siskiyou	16
Glendora	91741	Los Angeles	9	Harbor City	90710	Los Angeles	6
Glenn	95943	Butte	11	Hat Creek	96040	Shasta	16
Glenn	95943	Glenn	11	Hawaiian			
Glennville	93226	Kern	16	Gardens	90716	Los Angeles	8
Gold Run	95717	Placer	16	Hawthorne	90250	Los Angeles	8
Goleta	93117	Santa Barbara	6	Hayford	96041	Trinity	16
Gonzales	93926	Monterey	3	Hayward	94541	Alameda	3
Goodyears Bar	95944	Sierra	16	Hayward	94542	Alameda	3
Grand Terrace	92313	San Bernardino	10	Hayward	94544	Alameda	3
				Hayward	94545	Alameda	3

<u>Healdsburg</u>	<u>95448</u>	<u>Sonoma</u>	<u>2</u>	<u>Hyampom</u>	<u>96046</u>	<u>Trinity</u>	<u>16</u>
<u>CITY</u>	<u>ZIP CODE</u>	<u>COUNTY</u>	<u>CZ</u>	<u>Hydesville</u>	<u>95547</u>	<u>Humboldt</u>	<u>1</u>
<u>Heber</u>	<u>92249</u>	<u>Imperial</u>	<u>15</u>				
<u>Helendale</u>	<u>92342</u>	<u>San Bernardino</u>	<u>14</u>	J			
<u>Helm</u>	<u>93627</u>	<u>Fresno</u>	<u>13</u>				
<u>Hemet</u>	<u>92543</u>	<u>Riverside</u>	<u>10</u>	<u>Idyllwild</u>	<u>92549</u>	<u>Riverside</u>	<u>16</u>
<u>Hemet</u>	<u>92544</u>	<u>Riverside</u>	<u>10</u>	<u>Igo</u>	<u>96047</u>	<u>Shasta</u>	<u>11</u>
<u>Hemet</u>	<u>92545</u>	<u>Riverside</u>	<u>10</u>	<u>Imperial</u>	<u>92251</u>	<u>Imperial</u>	<u>15</u>
<u>Herald</u>	<u>95638</u>	<u>Sacramento</u>	<u>12</u>	<u>Independence</u>	<u>93526</u>	<u>Inyo</u>	<u>16</u>
<u>Hercules</u>	<u>94547</u>	<u>Contra Costa</u>	<u>3</u>	<u>Indian Wells</u>	<u>92210</u>	<u>Riverside</u>	<u>15</u>
<u>Herlong</u>	<u>96113</u>	<u>Lassen</u>	<u>16</u>	<u>Indio</u>	<u>92201</u>	<u>Riverside</u>	<u>15</u>
<u>Hermosa Beach</u>	<u>90254</u>	<u>Los Angeles</u>	<u>6</u>	<u>Indio</u>	<u>92203</u>	<u>Riverside</u>	<u>15</u>
<u>Hesperia</u>	<u>92344</u>	<u>San Bernardino</u>	<u>14</u>	<u>Inglewood</u>	<u>90301</u>	<u>Los Angeles</u>	<u>8</u>
<u>Hesperia</u>	<u>92345</u>	<u>San Bernardino</u>	<u>14</u>	<u>Inglewood</u>	<u>90302</u>	<u>Los Angeles</u>	<u>8</u>
<u>Hickman</u>	<u>95323</u>	<u>Stanislaus</u>	<u>12</u>	<u>Inglewood</u>	<u>90303</u>	<u>Los Angeles</u>	<u>8</u>
<u>Hidden Hills</u>	<u>91302</u>	<u>Los Angeles</u>	<u>9</u>	<u>Inglewood</u>	<u>90304</u>	<u>Los Angeles</u>	<u>8</u>
<u>Hidden Valley</u>				<u>Inglewood</u>	<u>90305</u>	<u>Los Angeles</u>	<u>8</u>
<u>Lake</u>	<u>95467</u>	<u>Lake</u>	<u>2</u>	<u>CITY</u>	<u>ZIP CODE</u>	<u>COUNTY</u>	<u>CZ</u>
<u>Highland</u>	<u>92346</u>	<u>San Bernardino</u>	<u>10</u>	<u>Inverness</u>	<u>94937</u>	<u>Marin</u>	<u>3</u>
<u>Hilmar</u>	<u>95324</u>	<u>Merced</u>	<u>12</u>	<u>Inyokern</u>	<u>93527</u>	<u>Inyo</u>	<u>16</u>
<u>Hinley</u>	<u>92347</u>	<u>San Bernardino</u>	<u>14</u>	<u>Inyokern</u>	<u>93527</u>	<u>Kern</u>	<u>16</u>
<u>Hollister</u>	<u>95023</u>	<u>San Benito</u>	<u>4</u>	<u>Ione</u>	<u>95640</u>	<u>Amador</u>	<u>12</u>
<u>Hollister</u>	<u>95023</u>	<u>Santa Clara</u>	<u>4</u>	<u>Irvine</u>	<u>92602</u>	<u>Orange</u>	<u>8</u>
<u>Holtville</u>	<u>92250</u>	<u>Imperial</u>	<u>15</u>	<u>Irvine</u>	<u>92603</u>	<u>Orange</u>	<u>8</u>
<u>Homeland</u>	<u>92548</u>	<u>Riverside</u>	<u>10</u>	<u>Irvine</u>	<u>92604</u>	<u>Orange</u>	<u>8</u>
<u>Homewood</u>	<u>96141</u>	<u>Placer</u>	<u>16</u>	<u>Irvine</u>	<u>92606</u>	<u>Orange</u>	<u>8</u>
<u>Hoopa</u>	<u>95546</u>	<u>Humboldt</u>	<u>2</u>	<u>Irvine</u>	<u>92612</u>	<u>Orange</u>	<u>8</u>
<u>Hopland</u>	<u>95449</u>	<u>Mendocino</u>	<u>2</u>	<u>Irvine</u>	<u>92614</u>	<u>Orange</u>	<u>8</u>
<u>Hornbrook</u>	<u>96044</u>	<u>Siskiyou</u>	<u>16</u>	<u>Irvine</u>	<u>92617</u>	<u>Orange</u>	<u>8</u>
<u>Hornitos</u>	<u>95325</u>	<u>Mariposa</u>	<u>12</u>	<u>Irvine</u>	<u>92618</u>	<u>Orange</u>	<u>8</u>
<u>Hughson</u>	<u>95326</u>	<u>Stanislaus</u>	<u>12</u>	<u>Irvine</u>	<u>92620</u>	<u>Orange</u>	<u>8</u>
<u>Huntington Beach</u>	<u>92646</u>	<u>Orange</u>	<u>6</u>	<u>Irvine</u>	<u>92697</u>	<u>Orange</u>	<u>8</u>
<u>Huntington Beach</u>	<u>92647</u>	<u>Orange</u>	<u>6</u>	<u>Isleton</u>	<u>95641</u>	<u>Sacramento</u>	<u>12</u>
<u>Huntington Beach</u>	<u>92648</u>	<u>Orange</u>	<u>6</u>	<u>Ivanhoe</u>	<u>93235</u>	<u>Tulare</u>	<u>13</u>
<u>Huntington Beach</u>	<u>92649</u>	<u>Orange</u>	<u>6</u>				
<u>Huntington Park</u>	<u>90255</u>	<u>Los Angeles</u>	<u>8</u>	J			
<u>Huron</u>	<u>93234</u>	<u>Fresno</u>	<u>13</u>		<u>95642</u>	<u>Amador</u>	<u>12</u>
<u>Hyampom</u>	<u>96046</u>	<u>Humboldt</u>	<u>16</u>				

Jackson				Korbel	95550	Humboldt	2
Jacumba	91934	San Diego	14	Kyburz	95720	El Dorado	16
Jamestown	95327	Tuolumne	12				
Jamul	91935	San Diego	10	L			
Janesville	96114	Lassen	16				
Janesville	96114	Plumas	16	La Canada			
Jenner	95450	Sonoma	1	Flintridge	91011	Los Angeles	16
Johannesburg	93528	Kern	14	La Grange	95329	Mariposa	12
Johnson Valley	92285	San Bernardino	14	La Grange	95329	Stanislaus	12
Joshua Tree	92252	San Bernardino	14	La Grange	95329	Tuolumne	12
Julian	92036	San Diego	15	La Habra	90631	Los Angeles	8
Junction City	96048	Trinity	16	La Habra	90631	Orange	8
June Lake	93529	Mono	16	La Honda	94020	San Mateo	3
				La Honda	94020	Santa Clara	3
K				La Mesa	91941	San Diego	10
				La Mesa	91942	San Diego	10
Keene	93531	Kern	16	La Mirada	90638	Los Angeles	9
Kelseyville	95451	Lake	2	La Mirada	90639	Los Angeles	9
Kelso	92309	San Bernardino	14	La Palma	90623	Orange	8
Kentfield	94904	Marin	2	La Porte	95981	Plumas	16
Kenwood	95452	Sonoma	2	La Porte	95981	Yuba	16
Kerman	93630	Fresno	13	La Puente	91744	Los Angeles	9
Kernville	93238	Kern	16	La Puente	91746	Los Angeles	9
Kettleman City	93239	Kings	13	La Quinta	92253	Riverside	15
King City	93930	Monterey	4	La Verne	91750	Los Angeles	9
Kings Beach	96143	Placer	16	Lafayette	94549	Contra Costa	12
Kings Canyon National Park	93633	Fresno	16	Laguna Beach	92651	Orange	6
Kingsburg	93631	Fresno	13	Laguna Hills	92653	Orange	8
Kingsburg	93631	Kings	13	Laguna Niguel	92677	Orange	6
Kingsburg	93631	Tulare	13	Laguna Woods	92637	Orange	8
Klamath	95548	Del Norte	1	Lagunitas	94938	Marin	3
Klamath River	96050	Siskiyou	16	Lagunitas-Forest Knolls	94933	Marin	3
Kneeland	95549	Humboldt	2	Lake Arrowhead	92352	San Bernardino	16
CITY	ZIP CODE	COUNTY	CZ	Lake City	96115	Modoc	16
Knights Landing	95645	Sutter	11	Lake Elsinore	92530	Orange	10
Knights Landing	95645	Yolo	11	Lake Elsinore	92530	Riverside	10
Knightsen	94548	Contra Costa	12	Lake Elsinore	92532	Riverside	10

Lake Hughes	93532	Los Angeles	14	Litchfield	96117	Lassen	16
Lake Isabella	93240	Kern	16	Littlerock	93543	Los Angeles	14
Lake View Ter	91342	Los Angeles	9	Live Oaks	95953	Sutter	11
Lakehead	96051	Shasta	11	Live Oaks	95953	Yuba	11
Lakeport	95453	Lake	2	Livermore	94550	Alameda	12
Lakeside	92040	San Diego	10	Livermore	94550	Santa Clara	12
Lakewood	90712	Los Angeles	8	Livermore	94551	Alameda	12
Lakewood	90713	Los Angeles	8	Livermore	94551	Contra Costa	12
Lakewood	90715	Los Angeles	8	Livingston	95334	Merced	12
Lamont	93241	Kern	13	Llano	93544	Los Angeles	14
Lancaster	93534	Los Angeles	14	Lockerford	95237	San Joaquin	12
Lancaster	93535	Los Angeles	14	Lockwood	93932	Monterey	4
CITY	ZIP CODE	COUNTY	CZ	Lodi	95240	San Joaquin	12
Lancaster	93536	Kern	14	Lodi	95242	San Joaquin	12
Lancaster	93536	Los Angeles	14	Loleta	95551	Humboldt	1
Larkspur	94939	Marin	3	Loma Linda	92350	San Bernardino	10
Lathrop	95330	San Joaquin	12	Loma Linda	92354	San Bernardino	10
Laton	93242	Fresno	13	Lomita	90717	Los Angeles	6
Laton	93242	Kings	13	Lompoc	93436	Santa Barbara	5
Lawndale	90260	Los Angeles	8	Lompoc	93437	Santa Barbara	5
Laytonville	95454	Mendocino	2	Lone Pine	93545	Inyo	16
Laytonville- Leggett	95488	Mendocino	1	Long Barn	95335	Tuolumne	16
Laytonville- Leggett	95585	Mendocino	1	Long Beach	90802	Los Angeles	6
Le Grand	95333	Merced	12	Long Beach	90803	Los Angeles	6
Lebec	93243	Kern	16	Long Beach	90804	Los Angeles	6
Lebec	93243	Los Angeles	16	Long Beach	90805	Los Angeles	8
Lebec	93243	Ventura	16	Long Beach	90806	Los Angeles	6
Lee Vining	93541	Mono	16	Long Beach	90807	Los Angeles	8
Lemon Grove	91945	San Diego	10	CITY	ZIP CODE	COUNTY	CZ
Lemoncove	93244	Tulare	13	Long Beach	90808	Los Angeles	8
Lemoore	93245	Kings	13	Long Beach	90810	Los Angeles	6
Lewiston	96052	Trinity	16	Long Beach	90813	Los Angeles	6
Likely	96116	Modoc	16	Long Beach	90814	Los Angeles	6
Lincoln	95648	Placer	11	Long Beach	90815	Los Angeles	6
Linden	95236	San Joaquin	12	Long Beach	90840	Los Angeles	6
Lindsay	93247	Tulare	13	Lookout	96054	Modoc	16
				Loomis	95650	Placer	11
				Los Alamitos	90720	Orange	8

Los Altos	94022	Santa Clara	4	Los Angeles	90039	Los Angeles	9
Los Altos	94024	Santa Clara	4	Los Angeles	90040	Los Angeles	8
Los Angeles	90001	San Diego	8	Los Angeles	90041	Los Angeles	9
Los Angeles	90002	San Diego	8	Los Angeles	90042	Los Angeles	9
Los Angeles	90003	San Diego	8	Los Angeles	90043	Los Angeles	8
Los Angeles	90004	Los Angeles	9	CITY	ZIP CODE	COUNTY	CZ
Los Angeles	90005	Los Angeles	9	Los Angeles	90044	Los Angeles	8
Los Angeles	90006	Los Angeles	9	Los Angeles	90045	Los Angeles	6
Los Angeles	90007	Los Angeles	8	Los Angeles	90046	Los Angeles	9
Los Angeles	90008	Los Angeles	8	Los Angeles	90047	Los Angeles	8
Los Angeles	90010	Los Angeles	9	Los Angeles	90048	Los Angeles	9
Los Angeles	90011	Los Angeles	8	Los Angeles	90049	Los Angeles	6
Los Angeles	90012	Los Angeles	9	Los Angeles	90056	Los Angeles	8
Los Angeles	90013	Los Angeles	9	Los Angeles	90057	Los Angeles	9
Los Angeles	90014	Los Angeles	9	Los Angeles	90058	Los Angeles	8
Los Angeles	90015	Los Angeles	9	Los Angeles	90059	Los Angeles	8
Los Angeles	90016	Los Angeles	8	Los Angeles	90061	Los Angeles	8
Los Angeles	90017	Los Angeles	9	Los Angeles	90062	Los Angeles	8
Los Angeles	90018	Los Angeles	8	Los Angeles	90063	Los Angeles	9
Los Angeles	90019	Los Angeles	9	Los Angeles	90064	Los Angeles	9
Los Angeles	90020	Los Angeles	9	Los Angeles	90065	Los Angeles	9
Los Angeles	90021	Los Angeles	9	Los Angeles	90066	Los Angeles	6
Los Angeles	90022	Los Angeles	9	Los Angeles	90067	Los Angeles	9
Los Angeles	90023	Los Angeles	8	Los Angeles	90068	Los Angeles	9
Los Angeles	90024	Los Angeles	9	Los Angeles	90071	Los Angeles	9
Los Angeles	90025	Los Angeles	6	Los Angeles	90073	Los Angeles	6
Los Angeles	90026	Los Angeles	9	Los Angeles	90077	Los Angeles	9
Los Angeles	90027	Los Angeles	9	Los Angeles	90089	Los Angeles	8
Los Angeles	90028	Los Angeles	9	Los Angeles	90094	Los Angeles	6
Los Angeles	90029	Los Angeles	9	Los Angeles	90095	Los Angeles	9
Los Angeles	90031	Los Angeles	9	Los Angeles	91306	Los Angeles	9
Los Angeles	90032	Los Angeles	9	Los Angeles	91316	Los Angeles	9
Los Angeles	90033	Los Angeles	9	Los Angeles	91324	Los Angeles	9
Los Angeles	90034	Los Angeles	8	Los Angeles	91325	Los Angeles	9
Los Angeles	90035	Los Angeles	9	Los Angeles	91330	Los Angeles	9
Los Angeles	90036	Los Angeles	9	Los Angeles	91331	Los Angeles	9
Los Angeles	90037	Los Angeles	8	Los Angeles	91335	Los Angeles	9
Los Angeles	90038	Los Angeles	9	Los Angeles	91343	Los Angeles	9

Los Angeles	91356	Los Angeles	9	Malibu	90263	Los Angeles	6
Los Angeles	91401	Los Angeles	9	Malibu	90265	Los Angeles	6
Los Angeles	91402	Los Angeles	9	Mammoth Lakes	93546	Mono	16
Los Angeles	91403	Los Angeles	9	Manchester	95459	Mendocino	1
Los Angeles	91405	Los Angeles	9	Manhattan Beach	90266	Los Angeles	6
Los Angeles	91406	Los Angeles	9	Manteca	95336	San Joaquin	12
Los Angeles	91411	Los Angeles	9	Manteca	95337	San Joaquin	12
Los Angeles	91423	Los Angeles	9	Manton	96059	Shasta	11
Los Angeles	91436	Los Angeles	9	Manton	96059	Tehama	11
Los Angeles	91606	Los Angeles	9	March Air Reserve Base	92518	Riverside	10
Los Banos	93635	Merced	12	Maricopa	93252	Kern	13
Los Gatos	95030	Santa Clara	4	Maricopa	93252	San Luis Obispo	13
Los Gatos	95032	Santa Clara	4	Maricopa	93252	Santa Barbara	13
Los Gatos	95033	Santa Clara	4	Maricopa	93252	Ventura	13
Los Gatos	95033	Santa Cruz	4	Maricopa	93252	Ventura	13
Los Molinos	96055	Tehama	11	Marin del Rey	90292	Los Angeles	6
Lost Hills	93249	Kern	13	Marina	93933	Monterey	3
Lotus	95651	El Dorado	12	Mariposa	95338	Mariposa	12
Lower Lake	95457	Lake	2	Markleeville	96120	Alpine	16
Loyalton	96118	Sierra	16	Martinez	94553	Contra Costa	12
CITY	ZIP CODE	COUNTY	CZ	Marysville	95901	Butte	11
Lucerne	95458	Lake	2	Marysville	95901	Sutter	11
Lucerne Valley	92356	San Bernardino	14	Marysville	95901	Yuba	11
Ludlow	92338	San Bernardino	14	Mather	95655	Sacramento	12
Lynwood	90262	Los Angeles	8	Maxwell	95955	Colusa	11
Lytle Creek	92358	San Bernardino	16	Maywood	90270	Los Angeles	8
M				McArthur	96056	Lassen	16
				McArthur	96056	Modoc	16
				McArthur	96056	Shasta	16
				McClellan	95652	Sacramento	12
Macdoel	96058	Siskiyou	16	McCloud	96057	Siskiyou	16
Mad River	95552	Trinity	2	McFarland	93250	Kern	13
Madeline	96119	Lassen	16	McKinleyville	95519	Humboldt	1
Madera	93636	Madera	13	McKittrick	93251	Kern	13
Madera	93637	Madera	13	McKittrick	93251	San Luis Obispo	13
Madera	93638	Madera	13	Meadow Valley	95956	Plumas	16
Madison	95653	Yolo	12	Meadow Vista	95722	Placer	11
Magalia	95954	Butte	11	CITY	ZIP CODE	COUNTY	CZ

Mecca	92254	Riverside	15	Mojave	93501	Kern	14
Mendonico	95460	Mendocino	1	Mojave	93519	Kern	14
Mendonico-Anderson	95410	Mendocino	1	Mokelumne Hill	95245	Calaveras	12
Mendonico-Anderson	95456	Mendocino	1	Monrovia	91016	Los Angeles	9
Mendota	93640	Fresno	13	Montague	96064	Siskiyou	16
Menlo Park	94025	San Mateo	3	Montclair	91763	San Bernardino	10
Mentone	92359	San Bernardino	16	Monte Rio	95462	Sonoma	1
Merced	95340	Merced	12	Montebello	90640	Los Angeles	9
Merced	95341	Merced	12	Monterey	93940	Monterey	3
Merced	95348	Merced	12	Monterey	93943	Monterey	3
Meridian	95957	Sutter	11	Monterey Park	91754	Los Angeles	9
Middletown	95461	Lake	2	Monterey Park	91755	Los Angeles	9
Middletown	95461	Sonoma	2	Montgomery Creek	96065	Shasta	16
Midpines	95345	Mariposa	12	Montrose	91020	Los Angeles	9
Midway City	92655	Orange	6	CITY	ZIP CODE	COUNTY	CZ
Milford	96121	Lassen	16	Montrose	91214	Los Angeles	9
Mill Valley	94941	Marin	3	Moorpark	93021	Ventura	9
Millbrae	94030	San Mateo	3	Moraga	94556	Contra Costa	3
Millville	96062	Shasta	11	Moreno Valley	92551	Riverside	10
Milpitas	95035	Alameda	4	Moreno Valley	92553	Riverside	10
Milpitas	95035	Santa Clara	4	Moreno Valley	92555	Riverside	10
Mineral	96063	Plumas	16	Moreno Valley	92557	Riverside	10
Mineral	96063	Tehama	16	Morgan Hill	95037	Santa Clara	4
Mira Loma	91752	Riverside	10	Morongo Valley	92256	San Bernardino	14
Miramonte	93641	Fresno	13	Morro Bay	93442	San Luis Obispo	5
Mission Viejo	92691	Orange	8	Moss Beach	94038	San Mateo	3
Mission Viejo	92692	Orange	8	Moss Landing	95039	Monterey	3
Mission Viejo	92694	Orange	8	Mount Hamilton	95140	Santa Clara	4
Mi-Wuk Village	95346	Tuolumne	16	Mountain Center	92561	Riverside	16
Modesto	95350	Stanislaus	12	Mountain Ranch	95246	Calaveras	12
Modesto	95351	Stanislaus	12	Mountain View	94035	Santa Clara	4
Modesto	95354	Stanislaus	12	Mountain View	94040	Santa Clara	4
Modesto	95355	Stanislaus	12	Mountain View	94041	Santa Clara	4
Modesto	95356	Stanislaus	12	Mountain View	94043	Santa Clara	4
Modesto	95357	Stanislaus	12	Mt Baldy	91759	San Bernardino	16
Modesto	95358	Stanislaus	12	Mt Shasta	96067	Siskiyou	16
				Murphys	95247	Calaveras	12

Murrieta	92562	Riverside	10	North San Juan	95960	Yuba	16
Murrieta	92563	Riverside	10	Northwest Marin	94940	Marin	3
				Norwalk	90650	Los Angeles	8
N				Novato	94945	Marin	2
				Novato	94947	Marin	2
Napa	94558	Napa	2	Novato	94949	Marin	2
Napa	94558	Sonoma	2	Nuevo	92567	Riverside	10
Napa	94559	Napa	2				
National City	91950	San Diego	7	O			
Needles	92363	San Bernardino	15				
Nevada City	95959	Nevada	11	Oak Park	91377	Ventura	9
New Cuyama	93254	Santa Barbara	4	Oak Run	96069	Shasta	11
Neward	94560	Alameda	3	Oak View	93022	Ventura	9
Newberry Springs	92365	San Bernardino	14	Oakdale	95361	San Joaquin	12
Newcastle	95658	Placer	11	Oakdale	95361	Stanislaus	12
Newman	95360	Merced	12	Oakhurst	93644	Madera	16
Newman	95360	Stanislaus	12	Oakhurst	93644	Mariposa	16
Newport Beach	92657	Orange	6	Oakland	94601	Alameda	3
Newport Beach	92660	Orange	6	Oakland	94602	Alameda	3
Newport Beach	92661	Orange	6	Oakland	94603	Alameda	3
Newport Beach	92663	Orange	6	Oakland	94605	Alameda	3
Nicasio	94946	Marin	2	Oakland	94606	Alameda	3
Nice	95464	Lake	2	Oakland	94607	Alameda	3
Nicolaus	95659	Sutter	11	Oakland	94609	Alameda	3
Niland	92257	Imperial	15	Oakland	94610	Alameda	3
Nipomo	93444	San Luis Obispo	5	Oakland	94611	Alameda	3
Nipton	92364	San Bernardino	14	Oakland	94611	Contra Costa	3
Norco	92860	Riverside	10	Oakland	94612	Alameda	3
Norden	95724	Nevada	16	Oakland	94613	Alameda	3
Norden	95724	Placer	16	Oakland	94618	Alameda	3
North Coast	90742	Orange	6	Oakland	94619	Alameda	3
CITY	ZIP CODE	COUNTY	CZ	Oakland	94621	Alameda	3
North Edwards	93523	Kern	14	Oakley	94561	Contra Costa	12
North Fork	93643	Madera	16	Occidental	95465	Sonoma	1
North Highlands	95660	Sacramento	12	Oceano	93445	San Luis Obispo	5
North San Juan	95960	Nevada	16	Oceanside	92054	San Diego	7
North San Juan	95960	Sierra	16	Oceanside	92056	San Diego	7
				Oceanside	92057	San Diego	7

Oceanside	92058	San Diego	7	P			
Ocotillo	92259	Imperial	15				
Ojai	93023	Ventura	16	Pacific Grove			
Old Station	96071	Shasta	16	Pacific PLSDS	90272	Los Angeles	6
Olivehurst	95961	Yuba	11	Pacifica	94044	San Mateo	3
O'Neals	93645	Madera	13	Paicines	95043	Fresno	4
Ontario	91761	San Bernardino	10	Paicines	95043	San Benito	4
Ontario	91762	San Bernardino	10	Pala	92059	San Diego	10
Ontario	91764	San Bernardino	10	Palermo	95968	Butte	11
Onyx	93255	Kern	16	Palm Desert	92211	Riverside	15
CITY	ZIP CODE	COUNTY	CZ	Palm Desert	92260	Riverside	15
Orange	92862	Orange	8	Palm Springs	92262	Riverside	15
Orange	92865	Orange	8	Palm Springs	92264	Riverside	15
Orange	92866	Orange	8	Palmdale	93550	Los Angeles	14
Orange	92867	Orange	8	Palmdale	93551	Los Angeles	14
Orange	92868	Orange	8	Palmdale	93552	Los Angeles	14
Orange	92869	Orange	8	Palmdale	93591	Los Angeles	14
Orange Cove	93646	Fresno	13	Palo Alto	94301	Santa Clara	4
Orange Cove	93646	Tulare	13	Palo Alto	94303	San Mateo	4
Orangevale	95662	Sacramento	12	Palo Alto	94303	Santa Clara	4
Oregon House	95962	Yuba	11	Palo Alto	94304	Santa Clara	4
Orick	95555	Humboldt	1	Palo Alto	94306	Santa Clara	4
Orinda	94563	Contra Costa	12	Palo Cedro	96073	Shasta	11
Orland	95963	Glenn	11	Palos Verdes			
Orland	95963	Tehama	11	Peninsula	90274	Los Angeles	6
Orleans	95556	Humboldt	2	Paradise	95969	Butte	11
Oro Grande	92368	San Bernardino	14	Paramount	90723	Los Angeles	8
Orosi	93647	Fresno	13	CITY	ZIP CODE	COUNTY	CZ
Orosi	93647	Tulare	13	Parker Dam	92267	San Bernardino	15
Oroville	95965	Butte	11	Parlier	93648	Fresno	13
Oroville	95966	Butte	11	Pasadena	91101	Los Angeles	9
Oroville	95966	Yuba	11	Pasadena	91103	Los Angeles	9
Oxnard	93030	Ventura	6	Pasadena	91104	Los Angeles	9
Oxnard	93033	Ventura	6	Pasadena	91105	Los Angeles	9
Oxnard	93035	Ventura	6	Pasadena	91106	Los Angeles	9
Oxnard	93036	Ventura	6	Pasadena	91107	Los Angeles	16
	93950	Monterey	3	Pasadena	91123	Los Angeles	9
				Paso Robles	93446	San Luis Obispo	4

Patterson	95363	Stanislaus	12	Pleasant Grove	95668	Placer	11
Pauma Valley	92061	San Diego	10	Pleasant Grove	95668	Sutter	11
Paynes Creek	96075	Tehama	11	Pleasant Hill	94523	Contra Costa	12
Pearblossom	93553	Los Angeles	14	Pleasanton	94566	Alameda	12
Pebble Beach	93953	Monterey	3	CITY	ZIP CODE	COUNTY	CZ
Penn Valley	95946	Nevada	11	Pleasanton	94588	Alameda	12
Penngrove	94951	Sonoma	2	Plymouth	95669	Amador	12
Penryn	95663	Placer	11	Point Arena	95468	Mendocino	1
Perris	92570	Riverside	10	Point Reyes Station	94956	Marin	3
Perris	92571	Riverside	10	Pollock Pines	95726	El Dorado	16
Pescadero	94060	San Mateo	3	Pomona	91766	Los Angeles	9
Pescadero	94060	Santa Cruz	3	Pomona	91766	San Bernardino	9
Petaluma	94952	Marin	2	Pomona	91767	Los Angeles	9
Petaluma	94952	Sonoma	2	Pomona	91768	Los Angeles	9
Petaluma	94954	Sonoma	2	Pope Valley	94567	Napa	2
Petrolia	95558	Humboldt	1	Port Costa	94569	Contra Costa	12
Phelan	92371	San Bernardino	14	Port Hueneme	93041	Ventura	6
Philo	95466	Mendocino	2	Port Hueneme	93042	Ventura	6
Pico Rivera	90660	Los Angeles	9	Port Hueneme	93043	Ventura	6
Piercy	95587	Mendocino	2	Porter Ranch	91326	Los Angeles	9
Pilot Hill	95664	El Dorado	12	Porterville	93257	Tulare	13
Pilot Hill	95664	Placer	12	Portola	96122	Plumas	16
Pine Grove	95665	Amador	12	Portola Valley	94028	San Mateo	3
Pine Valley	91962	San Diego	14	Portola Valley	94028	Santa Clara	3
Pinecrest	95364	Tuolumne	16	Posey	93260	Tulare	16
Pinole	94564	Contra Costa	3	Potrero	91963	San Diego	14
Pinon Hills	92372	San Bernardino	14	Potter Valley	95469	Lake	2
Pioneer	95666	Amador	16	Potter Valley	95469	Mendocino	2
Pioneer	95666	El Dorado	16	Poway	92064	San Diego	10
Pismo Beach	93449	San Luis Obispo	5	Prather	93651	Fresno	13
Pittsburg	94565	Contra Costa	12	Princeton	95970	Colusa	11
Pixley	93256	Tulare	13	Princeton	95970	Glenn	11
Placencia	92870	Orange	8				
Placerville	95667	El Dorado	12				
Platina	96076	Shasta	11	Q			
Platina	96076	Tehama	11				
Platina	96076	Trinity	11	Quincy	95971	Plumas	16
Playa Del Ray	90293	Los Angeles	6		95972	Yuba	11

R				<u>Redwood City</u>	<u>94062</u>	<u>San Mateo</u>	<u>3</u>
				<u>Redwood City</u>	<u>94063</u>	<u>San Mateo</u>	<u>3</u>
<u>Rackerby</u>				<u>Redwood City</u>	<u>94065</u>	<u>San Mateo</u>	<u>3</u>
<u>Raisin City</u>	<u>93652</u>	<u>Fresno</u>	<u>13</u>	<u>Redwood Valley</u>	<u>95470</u>	<u>Mendocino</u>	<u>2</u>
<u>Ramona</u>	<u>92065</u>	<u>San Diego</u>	<u>10</u>	<u>Reedley</u>	<u>93654</u>	<u>Fresno</u>	<u>13</u>
<u>Ranchita</u>	<u>92066</u>	<u>San Diego</u>	<u>14</u>	<u>Reedley</u>	<u>93654</u>	<u>Tulare</u>	<u>13</u>
<u>Rancho Cordova</u>	<u>95670</u>	<u>Sacramento</u>	<u>12</u>	<u>Rescue</u>	<u>95672</u>	<u>El Dorado</u>	<u>12</u>
<u>Rancho Cordova</u>	<u>95742</u>	<u>Sacramento</u>	<u>12</u>	<u>Rialto</u>	<u>92376</u>	<u>San Bernardino</u>	<u>10</u>
<u>Rancho Cucamonga</u>	<u>91701</u>	<u>San Bernardino</u>	<u>10</u>	<u>Rialto</u>	<u>92377</u>	<u>San Bernardino</u>	<u>10</u>
<u>Rancho Cucamonga</u>	<u>91730</u>	<u>San Bernardino</u>	<u>10</u>	<u>Richmond</u>	<u>94801</u>	<u>Contra Costa</u>	<u>3</u>
<u>Rancho Cucamonga</u>	<u>91737</u>	<u>San Bernardino</u>	<u>10</u>	<u>Richmond</u>	<u>94804</u>	<u>Contra Costa</u>	<u>3</u>
<u>Rancho Cucamonga</u>	<u>91739</u>	<u>San Bernardino</u>	<u>10</u>	<u>Richmond</u>	<u>94805</u>	<u>Contra Costa</u>	<u>3</u>
<u>Rancho Mirage</u>	<u>92270</u>	<u>Riverside</u>	<u>15</u>	<u>Ridgecrest</u>	<u>93555</u>	<u>Inyo</u>	<u>14</u>
<u>Rancho Palos Verdes</u>	<u>90275</u>	<u>Los Angeles</u>	<u>6</u>	<u>Ridgecrest</u>	<u>93555</u>	<u>Kern</u>	<u>14</u>
<u>Rancho Santa Margarita</u>	<u>92688</u>	<u>Orange</u>	<u>8</u>	<u>Ridgecrest</u>	<u>93555</u>	<u>San Bernardino</u>	<u>14</u>
<u>CITY</u>	<u>ZIP CODE</u>	<u>COUNTY</u>	<u>CZ</u>	<u>Rio Dell</u>	<u>95562</u>	<u>Humboldt</u>	<u>1</u>
<u>Rancho Sante Fe</u>	<u>92067</u>	<u>San Diego</u>	<u>7</u>	<u>Rio Linda</u>	<u>95673</u>	<u>Sacramento</u>	<u>12</u>
<u>Rancho Sante Fe</u>	<u>92091</u>	<u>San Diego</u>	<u>7</u>	<u>Rio Oso</u>	<u>95674</u>	<u>Sutter</u>	<u>11</u>
<u>Randsburg</u>	<u>93554</u>	<u>Kern</u>	<u>14</u>	<u>Rio Oso</u>	<u>95674</u>	<u>Yuba</u>	<u>11</u>
<u>Ravendale</u>	<u>96123</u>	<u>Lassen</u>	<u>16</u>	<u>Rio Vista</u>	<u>94571</u>	<u>Sacramento</u>	<u>12</u>
<u>Raymond</u>	<u>93653</u>	<u>Madera</u>	<u>13</u>	<u>Rio Vista</u>	<u>94571</u>	<u>Solano</u>	<u>12</u>
<u>Raymond</u>	<u>93653</u>	<u>Mariposa</u>	<u>13</u>	<u>Ripon</u>	<u>95366</u>	<u>San Joaquin</u>	<u>12</u>
<u>Red Bluff</u>	<u>96080</u>	<u>Tehama</u>	<u>11</u>	<u>Riverbank</u>	<u>95367</u>	<u>Stanislaus</u>	<u>12</u>
<u>Redcrest</u>	<u>95569</u>	<u>Humboldt</u>	<u>2</u>	<u>Riverdale</u>	<u>93656</u>	<u>Fresno</u>	<u>13</u>
<u>Redding</u>	<u>96001</u>	<u>Shasta</u>	<u>11</u>	<u>Riverdale</u>	<u>93656</u>	<u>Kings</u>	<u>13</u>
<u>Redding</u>	<u>96002</u>	<u>Shasta</u>	<u>11</u>	<u>Riverside</u>	<u>92501</u>	<u>Riverside</u>	<u>10</u>
<u>Redding</u>	<u>96003</u>	<u>Shasta</u>	<u>11</u>	<u>Riverside</u>	<u>92503</u>	<u>Riverside</u>	<u>10</u>
<u>Redlands</u>	<u>92373</u>	<u>Riverside</u>	<u>10</u>	<u>Riverside</u>	<u>92504</u>	<u>Riverside</u>	<u>10</u>
<u>Redlands</u>	<u>92373</u>	<u>San Bernardino</u>	<u>10</u>	<u>Riverside</u>	<u>92505</u>	<u>Riverside</u>	<u>10</u>
<u>Redlands</u>	<u>92374</u>	<u>San Bernardino</u>	<u>10</u>	<u>Riverside</u>	<u>92506</u>	<u>Riverside</u>	<u>10</u>
<u>Redondo Beach</u>	<u>90277</u>	<u>Los Angeles</u>	<u>6</u>	<u>Riverside</u>	<u>92507</u>	<u>Riverside</u>	<u>10</u>
<u>Redondo Beach</u>	<u>90278</u>	<u>Los Angeles</u>	<u>6</u>	<u>Riverside</u>	<u>92508</u>	<u>Riverside</u>	<u>10</u>
<u>Redway</u>	<u>95560</u>	<u>Humboldt</u>	<u>2</u>	<u>Riverside</u>	<u>92509</u>	<u>Riverside</u>	<u>10</u>
<u>Redwood City</u>	<u>94061</u>	<u>San Mateo</u>	<u>3</u>	<u>Riverside</u>	<u>92509</u>	<u>San Bernardino</u>	<u>10</u>
				<u>CITY</u>	<u>ZIP CODE</u>	<u>COUNTY</u>	<u>CZ</u>
				<u>Riverside</u>	<u>92521</u>	<u>Riverside</u>	<u>10</u>
				<u>Rocklin</u>	<u>95677</u>	<u>Placer</u>	<u>11</u>
				<u>Rodeo</u>	<u>94572</u>	<u>Contra Costa</u>	<u>3</u>

Rohnert Park	94928	Sonoma	2	Sacramento	95836	Sacramento	12
Rosamond	93560	Kern	14	Sacramento	95836	Sutter	12
Rosamond	93560	Los Angeles	14	Sacramento	95837	Sacramento	12
Rosemead	91770	Los Angeles	9	Sacramento	95837	Sutter	12
Roseville	95661	Placer	11	Sacramento	95838	Sacramento	12
Roseville	95661	Sacramento	11	Sacramento	95841	Sacramento	12
Roseville	95678	Placer	11	Sacramento	95842	Sacramento	12
Roseville	95747	Placer	11	Sacramento	95843	Sacramento	12
Rough and Ready	95975	Nevada	11	Sacramento	95864	Sacramento	12
Rowland Heights	91748	Los Angeles	9	Salida	95368	Stanislaus	12
Rumsey	95679	Yolo	12	Salinas	93901	Monterey	3
Running Springs	92382	San Bernardino	16	Salinas	93905	Monterey	3
				CITY	ZIP CODE	COUNTY	CZ
S				Salinas	93906	Monterey	3
				Salinas	93907	Monterey	3
Sacramento	95811	Sacramento	12	Salinas	93908	Monterey	3
Sacramento	95814	Sacramento	12	Salyer	95563	Trinity	16
Sacramento	95815	Sacramento	12	Samoa	95564	Humboldt	1
Sacramento	95816	Sacramento	12	San Andreas	95249	Calaveras	12
Sacramento	95817	Sacramento	12	San Anselmo	94960	Marin	2
Sacramento	95818	Sacramento	12	San Ardo	93450	Monterey	4
Sacramento	95819	Sacramento	12	San Bernardino	92401	San Bernardino	10
Sacramento	95820	Sacramento	12	San Bernardino	92404	San Bernardino	16
Sacramento	95821	Sacramento	12	San Bernardino	92405	San Bernardino	10
Sacramento	95822	Sacramento	12	San Bernardino	92407	San Bernardino	10
Sacramento	95823	Sacramento	12	San Bernardino	92408	San Bernardino	10
Sacramento	95824	Sacramento	12	San Bernardino	92410	San Bernardino	10
Sacramento	95825	Sacramento	12	San Bernardino	92411	San Bernardino	10
Sacramento	95826	Sacramento	12	San Bruno	94066	San Mateo	3
Sacramento	95827	Sacramento	12	San Carlos	94070	San Mateo	3
Sacramento	95828	Sacramento	12	San Clemente	92672	Orange	6
Sacramento	95829	Sacramento	12	San Clemente	92672	San Diego	6
Sacramento	95830	Sacramento	12	San Clemente	92673	Orange	6
Sacramento	95831	Sacramento	12	San Diego	92037	San Diego	7
Sacramento	95832	Sacramento	12	San Diego	92101	San Diego	7
Sacramento	95833	Sacramento	12	San Diego	92102	San Diego	7
Sacramento	95834	Sacramento	12	San Diego	92103	San Diego	7
Sacramento	95835	Sacramento	12	San Diego	92104	San Diego	7

San Diego	92105	San Diego	7	San Fernando	91340	Los Angeles	9
San Diego	92106	San Diego	7	San Fernando	91344	Los Angeles	9
San Diego	92107	San Diego	7	San Fernando	91345	Los Angeles	9
San Diego	92108	San Diego	7	San Fernando			
San Diego	92109	San Diego	7	Valley	91352	Los Angeles	9
San Diego	92110	San Diego	7	San Fernando			
San Diego	92111	San Diego	7	Valley	91602	Los Angeles	9
San Diego	92113	San Diego	7	San Fernando			
San Diego	92114	San Diego	7	Valley	91605	Los Angeles	9
San Diego	92114	San Diego	7	San Francisco	94102	San Francisco	3
San Diego	92115	San Diego	10	San Francisco	94103	San Francisco	3
San Diego	92116	San Diego	7	San Francisco	94104	San Francisco	3
San Diego	92117	San Diego	7	San Francisco	94105	San Francisco	3
San Diego	92119	San Diego	10	San Francisco	94107	San Francisco	3
San Diego	92120	San Diego	10	San Francisco	94108	San Francisco	3
San Diego	92121	San Diego	7	San Francisco	94109	San Francisco	3
San Diego	92122	San Diego	7	San Francisco	94110	San Francisco	3
San Diego	92123	San Diego	7	San Francisco	94111	San Francisco	3
San Diego	92124	San Diego	10	San Francisco	94112	San Francisco	3
San Diego	92126	San Diego	7	San Francisco	94112	San Mateo	3
San Diego	92127	San Diego	10	San Francisco	94114	San Francisco	3
San Diego	92128	San Diego	10	San Francisco	94115	San Francisco	3
San Diego	92129	San Diego	7	San Francisco	94116	San Francisco	3
San Diego	92130	San Diego	7	San Francisco	94117	San Francisco	3
San Diego	92131	San Diego	10	San Francisco	94118	San Francisco	3
San Diego	92133	San Diego	7	San Francisco	94121	San Francisco	3
San Diego	92134	San Diego	7	San Francisco	94122	San Francisco	3
San Diego	92135	San Diego	7	San Francisco	94123	San Francisco	3
<u>CITY</u>	<u>ZIP CODE</u>	<u>COUNTY</u>	<u>CZ</u>	San Francisco	94124	San Francisco	3
San Diego	92136	San Diego	7	San Francisco	94127	San Francisco	3
San Diego	92139	San Diego	7	San Francisco	94128	San Mateo	3
San Diego	92140	San Diego	7	San Francisco	94129	San Francisco	3
San Diego	92145	San Diego	7	San Francisco	94130	San Francisco	3
San Diego	92152	San Diego	7	San Francisco	94131	San Francisco	3
San Diego	92154	San Diego	7	San Francisco	94132	San Francisco	3
San Diego	92155	San Diego	7	San Francisco	94133	San Francisco	3
San Diego	92173	San Diego	7	San Francisco	94134	San Francisco	3
San Diego	92182	San Diego	7	San Francisco	94134	San Mateo	3
San Dimas	91773	Los Angeles	9	San Francisco	94158	San Francisco	3

San Gabriel	91775	Los Angeles	9	San Jose	95148	Santa Clara	4
San Gabriel	91776	Los Angeles	9	San Jose	95192	Santa Clara	4
San Geronimo	94963	Marin	2	San Juan Bautista	95045	San Benito	4
San Gregorio	94074	San Mateo	3	San Juan Capistrano	92675	Orange	6
CITY	ZIP CODE	COUNTY	CZ	CITY	ZIP CODE	COUNTY	CZ
San Jacinto	92582	Riverside	10	San Juan Capistrano	92675	Riverside	6
San Jacinto	92583	Riverside	10	San Leandro	94577	Alameda	3
San Joaquin	93660	Fresno	13	San Leandro	94578	Alameda	3
San Jose	95002	Santa Clara	4	San Leandro	94579	Alameda	3
San Jose	95013	Santa Clara	4	San Lorenzo	94580	Alameda	3
San Jose	95110	Santa Clara	4	San Luis Obispo	93401	San Luis Obispo	5
San Jose	95111	Santa Clara	4	San Luis Obispo	93402	San Luis Obispo	5
San Jose	95112	Santa Clara	4	San Luis Obispo	93405	San Luis Obispo	5
San Jose	95113	Santa Clara	4	San Luis Obispo	93407	San Luis Obispo	5
San Jose	95116	Santa Clara	4	San Marcos	92069	San Diego	10
San Jose	95117	Santa Clara	4	San Marcos	92078	San Diego	10
San Jose	95118	Santa Clara	4	San Marcos	92096	San Diego	10
San Jose	95119	Santa Clara	4	San Marino	91108	Los Angeles	9
San Jose	95120	Santa Clara	4	San Martin	95046	Santa Clara	4
San Jose	95121	Santa Clara	4	CITY	ZIP CODE	COUNTY	CZ
San Jose	95122	Santa Clara	4	San Mateo	94401	San Mateo	3
San Jose	95123	Santa Clara	4	San Mateo	94402	San Mateo	3
San Jose	95124	Santa Clara	4	San Mateo	94403	San Mateo	3
San Jose	95125	Santa Clara	4	San Mateo	94404	San Mateo	3
San Jose	95126	Santa Clara	4	San Miguel	93451	Kings	4
San Jose	95127	Santa Clara	4	San Miguel	93451	Monterey	4
San Jose	95128	Santa Clara	4	San Miguel	93451	San Luis Obispo	4
San Jose	95129	Santa Clara	4	San Pablo	94806	Contra Costa	3
San Jose	95130	Santa Clara	4	San Pedro	90731	Los Angeles	6
San Jose	95131	Santa Clara	4	San Pedro	90732	Los Angeles	6
San Jose	95132	Santa Clara	4	San Quentin	94964	Marin	2
San Jose	95133	Santa Clara	4	San Rafael	94901	Marin	2
San Jose	95134	Santa Clara	4	San Rafael	94903	Marin	2
San Jose	95135	Santa Clara	4	San Ramon	94582	Contra Costa	12
San Jose	95136	Santa Clara	4	San Ramon	94583	Alameda	12
San Jose	95138	Santa Clara	4	San Ramon	94583	Contra Costa	12
San Jose	95139	Santa Clara	4	San Simeon	93452	San Luis Obispo	5
San Jose	95141	Santa Clara	4				

Sanger	93657	Fresno	13	Santa Monica	90405	Los Angeles	6
Santa Ana	92701	Orange	8	Santa Paula	93060	Ventura	9
Santa Ana	92703	Orange	8	Santa Rosa	95401	Sonoma	2
Santa Ana	92704	Orange	8	Santa Rosa	95403	Sonoma	2
Santa Ana	92705	Orange	8	Santa Rosa	95404	Sonoma	2
Santa Ana	92706	Orange	8	Santa Rosa	95405	Sonoma	2
Santa Ana	92707	Orange	8	Santa Rosa	95407	Sonoma	2
Santa Barbara	93101	Santa Barbara	6	Santa Rosa	95409	Sonoma	2
Santa Barbara	93103	Santa Barbara	6	Santa Rosa	95439	Sonoma	2
Santa Barbara	93106	Santa Barbara	6	Santa Ynez	93460	Santa Barbara	5
Santa Barbara	93108	Santa Barbara	6	Santa Ynez Valley	93441	Santa Barbara	5
Santa Barbara	93109	Santa Barbara	6	Santa Ysabel	92070	San Diego	14
Santa Barbara	93110	Santa Barbara	6	Santee	92071	San Diego	10
Santa Barbara	93111	Santa Barbara	6	Saratoga	95070	Santa Clara	4
Santa Clara	95050	Santa Clara	4	Sausalito	94965	Marin	3
Santa Clara	95051	Santa Clara	4	Scotia	95565	Humboldt	1
Santa Clara	95053	Santa Clara	4	Scott Bar	96085	Siskiyou	16
Santa Clara	95054	Santa Clara	4	Scotts Valley	95066	Santa Cruz	3
Santa Clarita	91321	Los Angeles	9	Sea Ranch	95497	Sonoma	1
Santa Clarita	91350	Los Angeles	9	Seal Beach	90740	Orange	6
Santa Clarita	91354	Los Angeles	9	Seal Beach	90743	Orange	6
Santa Clarita	91355	Los Angeles	9	Seaside	93955	Monterey	3
Santa Cruz	95060	Santa Cruz	3	Sebastopol	95472	Sonoma	2
Santa Cruz	95062	Santa Cruz	3	Seiad Valley	96086	Siskiyou	16
Santa Cruz	95064	Santa Cruz	3	Selma	93662	Fresno	13
Santa Cruz	95065	Santa Cruz	3	Sequoia National Park	93262	Tulare	16
Santa Fe Springs	90670	Los Angeles	9	Shafter	93263	Kern	13
Santa Margar	93453	San Luis Obispo	4	Shandon	93461	Kern	4
Santa Maria	93454	San Luis Obispo	5	Shandon	93461	San Luis Obispo	4
Santa Maria	93454	Santa Barbara	5	Shasta	96087	Shasta	11
Santa Maria	93455	Santa Barbara	5	Shasta Lake	96019	Shasta	11
Santa Maria	93458	San Luis Obispo	5	Shaver Lake	93664	Fresno	16
Santa Maria	93458	Santa Barbara	5	Sheridan	95681	Placer	11
Santa Monica	90401	Los Angeles	6	Shingle Springs	95682	El Dorado	12
Santa Monica	90402	Los Angeles	6	Shingletown	96088	Shasta	11
CITY	ZIP CODE	COUNTY	CZ	Shoshone	92384	Inyo	14
Santa Monica	90403	Los Angeles	6	Sierra City	96125	Sierra	16
Santa Monica	90404	Los Angeles	6				

Sierra Madre	91024	Los Angeles	9	Squaw Valley	93675	Fresno	13
Sierraville	96126	Sierra	16	Squaw Valley	96146	Placer	16
Signal Hill	90755	Los Angeles	6	St Helena	94574	Napa	2
Silverado	92676	Orange	8	St Helena	94574	Sonoma	2
Simi Valley	93063	Los Angeles	9	Standish	96128	Lassen	16
Simi Valley	93063	Ventura	9	Stanford	94305	Santa Clara	4
Simi Valley	93065	Ventura	9	Stanton	90680	Orange	8
Skyforest	92385	San Bernardino	16	Stevenson Ranch	91381	Los Angeles	9
Sloughhouse	95683	Sacramento	12	Stevinson	95374	Merced	12
Smartsville	95977	Nevada	11	Stewarts Point	95480	Sonoma	1
Smartsville	95977	Yuba	11	Stinson Beach	94970	Marin	3
Smith River	95567	Del Norte	1	Stockton	95202	San Joaquin	12
Snelling	95369	Mariposa	12	Stockton	95203	San Joaquin	12
CITY	ZIP CODE	COUNTY	CZ	Stockton	95204	San Joaquin	12
Snelling	95369	Merced	12	Stockton	95205	San Joaquin	12
Soda Springs	95728	Nevada	16	Stockton	95206	San Joaquin	12
Soda Springs	95728	Placer	16	Stockton	95207	San Joaquin	12
Solano Beach	92075	San Diego	7	Stockton	95209	San Joaquin	12
Soledad	93960	Monterey	3	Stockton	95210	San Joaquin	12
Solvang	93463	Santa Barbara	5	Stockton	95211	San Joaquin	12
Somerset	95684	El Dorado	12	Stockton	95212	San Joaquin	12
Somes Bar	95568	Siskiyou	16	Stockton	95215	San Joaquin	12
Somis	93066	Ventura	9	Stockton	95219	San Joaquin	12
Sonoma	95476	Napa	2	Stonyford	95979	Colusa	11
Sonoma	95476	Sonoma	2	Stratford	93266	Kings	13
Sonora	95370	Tuolumne	12	Strathmore	93267	Tulare	13
Soquel	95073	Santa Cruz	3	Studio City	91604	Los Angeles	9
Soulsbyville	95372	Tuolumne	12	Suisun City	94585	Contra Costa	12
South Coastside	94021	San Mateo	3	Suisun City	94585	Solano	12
South El Monte	91733	Los Angeles	9	CITY	ZIP CODE	COUNTY	CZ
South Gate	90280	Los Angeles	8	Summerland	93067	Santa Barbara	6
South Lake Tahoe	96150	El Dorado	16	Sun City	92584	Riverside	10
South Pasadena	91030	Los Angeles	9	Sun City	92585	Riverside	10
South San Francisco	94080	San Mateo	3	Sun City	92586	Riverside	10
Spring Valley	91977	San Diego	10	Sun City	92587	Riverside	10
Spring Valley	91978	San Diego	10	Sunland	91040	Los Angeles	16
Springville	93265	Tulare	13	Sunnyside-Tahoe City	96145	Placer	16

Sunnyvale	94085	Santa Clara	4	Topanga	90290	Los Angeles	6
Sunnyvale	94086	Santa Clara	4	Topaz	96133	Mono	16
Sunnyvale	94087	Santa Clara	4	Torrance	90501	Los Angeles	6
Sunnyvale	94089	Santa Clara	4	Torrance	90502	Los Angeles	6
Sunol	94586	Alameda	12	Torrance	90503	Los Angeles	6
Susanville	96130	Lassen	16	Torrance	90504	Los Angeles	8
Sutter	95982	Sutter	11	Torrance	90505	Los Angeles	6
Sutter Creek	95685	Amador	12	<u>CITY</u>	<u>ZIP CODE</u>	<u>COUNTY</u>	<u>CZ</u>
				Torrance	90506	Los Angeles	8
I				Tracy	95304	San Joaquin	12
				Tracy	95376	San Joaquin	12
Taft	93268	Kern	13	Tracy	95377	Alameda	12
Tahoe Vista	96148	Placer	16	Tracy	95377	San Joaquin	12
Tahoma	96142	El Dorado	16	Tracy	95391	Alameda	12
Tahoma	96142	Placer	16	Tracy	95391	San Joaquin	12
Taylorsville	95983	Plumas	16	Tranquility	93668	Fresno	13
Tecate	91980	San Diego	14	Trinidad	95570	Humboldt	1
Tecopa	92389	Inyo	14	Trinity Center	96091	Trinity	16
Tehachapi	93561	Kern	16	Trona	93562	San Bernardino	14
Temeluca	92590	Riverside	10	Truckee	96161	Nevada	16
Temeluca	92591	Riverside	10	Truckee	96161	Placer	16
Temeluca	92592	Riverside	10	Truckee	96162	Nevada	16
Temple City	91780	Los Angeles	9	Truckee	96162	Placer	16
Templeton	93465	San Luis Obispo	4	Tujunga	91042	Los Angeles	16
Termo	96132	Lassen	16	Tulare	93274	Tulare	13
Terra Bella	93270	Tulare	13	Tulelake	96134	Modoc	16
Thermal	92274	Imperial	15	Tulelake	96134	Siskiyou	16
Thermal	92274	Riverside	15	Tuolumne	95379	Tuolumne	12
Thousand Oaks	91320	Ventura	9	Tupman	93276	Kern	13
Thousand Oaks	91360	Ventura	9	Turlock	95380	Merced	12
Thousand Oaks	91362	Los Angeles	9	Turlock	95380	Stanislaus	12
Thousand Oaks	91362	Ventura	9	Turlock	95382	Stanislaus	12
Thousand Palms	92276	Riverside	15	Tustin	92780	Orange	8
Three Rivers	93271	Tulare	13	Tustin	92782	Orange	8
Tipton	93272	Tulare	13	Twain	95984	Plumas	16
Tollhouse	93667	Fresno	13	Twain Harte	95383	Tuolumne	16
Toluca Ter	91601	Los Angeles	9	Twentynine Palms	92277	San Bernardino	14
Tomales	94971	Marin	3				

<u>Twentynine Palms</u>	<u>92278</u>	<u>San Bernardino</u>	<u>14</u>	<u>Vernalis</u>	<u>95385</u>	<u>Stanislaus</u>	<u>12</u>
<u>Twin Bridges</u>	<u>95735</u>	<u>El Dorado</u>	<u>16</u>	<u>Victorville</u>	<u>92392</u>	<u>San Bernardino</u>	<u>14</u>
				<u>Victorville</u>	<u>92394</u>	<u>San Bernardino</u>	<u>14</u>
				<u>Victorville</u>	<u>92395</u>	<u>San Bernardino</u>	<u>14</u>
				<u>Vidal</u>	<u>92280</u>	<u>San Bernardino</u>	<u>15</u>
				<u>Villa Park</u>	<u>92861</u>	<u>Orange</u>	<u>8</u>
<u>Ukiah</u>	<u>95482</u>	<u>Mendocino</u>	<u>2</u>	<u>Vinton</u>	<u>96135</u>	<u>Plumas</u>	<u>16</u>
<u>Union City</u>	<u>94587</u>	<u>Alameda</u>	<u>3</u>	<u>Visalia</u>	<u>93277</u>	<u>Tulare</u>	<u>13</u>
<u>Universal City</u>	<u>91608</u>	<u>Los Angeles</u>	<u>9</u>	<u>Visalia</u>	<u>93291</u>	<u>Tulare</u>	<u>13</u>
<u>Upland</u>	<u>91784</u>	<u>San Bernardino</u>	<u>10</u>	<u>Visalia</u>	<u>93292</u>	<u>Tulare</u>	<u>13</u>
<u>Upland</u>	<u>91786</u>	<u>Los Angeles</u>	<u>10</u>	<u>Vista</u>	<u>92081</u>	<u>San Diego</u>	<u>10</u>
<u>Upland</u>	<u>91786</u>	<u>San Bernardino</u>	<u>10</u>	<u>Vista</u>	<u>92083</u>	<u>San Diego</u>	<u>10</u>
<u>Upper Lake</u>	<u>95485</u>	<u>Lake</u>	<u>2</u>	<u>Vista</u>	<u>92084</u>	<u>San Diego</u>	<u>10</u>
<u>Upper Lake</u>	<u>95493</u>	<u>Lake</u>	<u>2</u>	<u>Volcano</u>	<u>95689</u>	<u>Amador</u>	<u>12</u>
<u>Upper Lake-Clearlake Oaks</u>	<u>95443</u>	<u>Lake</u>	<u>2</u>				
				<u>W</u>			
				<u>Walnut</u>	<u>91789</u>	<u>Los Angeles</u>	<u>9</u>
<u>Vacaville</u>	<u>95687</u>	<u>Solano</u>	<u>12</u>	<u>Walnut Creek</u>	<u>94595</u>	<u>Contra Costa</u>	<u>12</u>
<u>Vacaville</u>	<u>95688</u>	<u>Napa</u>	<u>12</u>	<u>Walnut Creek</u>	<u>94596</u>	<u>Contra Costa</u>	<u>12</u>
<u>Vacaville</u>	<u>95688</u>	<u>Solano</u>	<u>12</u>	<u>Walnut Creek</u>	<u>94597</u>	<u>Contra Costa</u>	<u>12</u>
<u>Vallecito</u>	<u>95251</u>	<u>Calaveras</u>	<u>12</u>	<u>Walnut Creek</u>	<u>94598</u>	<u>Contra Costa</u>	<u>12</u>
<u>CITY</u>	<u>ZIP CODE</u>	<u>COUNTY</u>	<u>CZ</u>	<u>Walnut Grove</u>	<u>95690</u>	<u>Sacramento</u>	<u>12</u>
<u>Vallejo</u>	<u>94589</u>	<u>Solano</u>	<u>2</u>	<u>Walnut Grove</u>	<u>95690</u>	<u>San Joaquin</u>	<u>12</u>
<u>Vallejo</u>	<u>94590</u>	<u>Solano</u>	<u>3</u>	<u>Walnut Grove</u>	<u>95690</u>	<u>Solano</u>	<u>12</u>
<u>Vallejo</u>	<u>94591</u>	<u>Solano</u>	<u>12</u>	<u>Warner Springs</u>	<u>92086</u>	<u>San Diego</u>	<u>14</u>
<u>Vallejo</u>	<u>94592</u>	<u>Solano</u>	<u>3</u>	<u>Wasco</u>	<u>93280</u>	<u>Kern</u>	<u>13</u>
<u>Valley Center</u>	<u>92082</u>	<u>San Diego</u>	<u>10</u>	<u>Waterford</u>	<u>95386</u>	<u>Stanislaus</u>	<u>12</u>
<u>Valley Ford</u>	<u>94972</u>	<u>Sonoma</u>	<u>1</u>	<u>Watsonville</u>	<u>95076</u>	<u>Monterey</u>	<u>3</u>
<u>Valley Springs</u>	<u>95252</u>	<u>Calaveras</u>	<u>12</u>	<u>Watsonville</u>	<u>95076</u>	<u>Santa Clara</u>	<u>3</u>
<u>Valley Village</u>	<u>91607</u>	<u>Los Angeles</u>	<u>9</u>	<u>Watsonville</u>	<u>95076</u>	<u>Santa Cruz</u>	<u>3</u>
<u>Valyermo</u>	<u>93563</u>	<u>Los Angeles</u>	<u>16</u>	<u>Weaverville</u>	<u>96093</u>	<u>Trinity</u>	<u>16</u>
<u>Venice</u>	<u>90291</u>	<u>Los Angeles</u>	<u>6</u>	<u>Weed</u>	<u>96094</u>	<u>Siskiyou</u>	<u>16</u>
<u>Ventura</u>	<u>93001</u>	<u>Ventura</u>	<u>6</u>	<u>Weldon</u>	<u>93283</u>	<u>Kern</u>	<u>16</u>
<u>Ventura</u>	<u>93003</u>	<u>Ventura</u>	<u>6</u>	<u>Wendel</u>	<u>96136</u>	<u>Lassen</u>	<u>16</u>
<u>Ventura</u>	<u>93004</u>	<u>Ventura</u>	<u>6</u>	<u>West Covina</u>	<u>91790</u>	<u>Los Angeles</u>	<u>9</u>
<u>Vernalis</u>	<u>95385</u>	<u>San Joaquin</u>	<u>12</u>	<u>West Covina</u>	<u>91791</u>	<u>Los Angeles</u>	<u>9</u>
				<u>West Covina</u>	<u>91792</u>	<u>Los Angeles</u>	<u>9</u>

West Hills	91304	Los Angeles	9	Winters	95694	Solano	12
CITY	ZIP CODE	COUNTY	CZ	Winters	95694	Yolo	12
West Hills	91304	Ventura	9	Winton	95388	Merced	12
West Hills	91307	Los Angeles	9	Wishon	93669	Madera	16
West Hills	91307	Ventura	9	Wofford Heights	93285	Kern	16
West Hollywood	90069	Los Angeles	9	Woodbridge	95258	San Joaquin	12
West Point	95255	Amador	12	Woodcare	94973	Marin	2
West Point	95255	Calaveras	12	Woodlake	93286	Tulare	13
West Sacramento	95605	Yolo	12	Woodland	95695	Yolo	12
West Sacramento	95691	Yolo	12	Woodland	95776	Yolo	12
Westlake Village	91361	Los Angeles	9	Woodland Hills	91303	Los Angeles	9
Westlake Village	91361	Ventura	9	Woodland Hills	91364	Los Angeles	9
Westminster	92683	Orange	6	Woodland Hills	91367	Los Angeles	9
Westmorland	92281	Imperial	15	Woodland Hills	91371	Los Angeles	9
Westwood	96137	Lassen	16	Woody	93287	Kern	13
Westwood	96137	Plumas	16	Wrightwood	92397	San Bernardino	16
Wheatland	95692	Yuba	11	CITY	ZIP CODE	COUNTY	CZ
White Water	92282	Riverside	15				
Whitethorn	95589	Humboldt	1	Y			
Whitethorn	95589	Mendocino	1				
Whitmore	96096	Shasta	11	Yorba Linda	92886	Orange	8
Whittier	90601	Los Angeles	9	Yorba Linda	92887	Orange	8
Whittier	90602	Los Angeles	9	Yorkville	95494	Mendocino	2
Whittier	90603	Los Angeles	9	Yosemite			
Whittier	90604	Los Angeles	9	National Park	95389	Mariposa	16
Whittier	90605	Los Angeles	9	Yosemite			
Whittier	90606	Los Angeles	9	National Park	95389	Tuolumne	16
Wildomar	92595	Riverside	10	Yountville	94599	Napa	2
Williams	95987	Colusa	11	Yreka	96097	Siskiyou	16
Willits	95490	Mendocino	2	Yuba City	95991	Sutter	11
Willow Creek	95573	Humboldt	2	Yuba City	95993	Sutter	11
Willows	95988	Glenn	11	Yucaipa	92399	Riverside	10
Wilmington	90744	Los Angeles	6	Yucaipa	92399	San Bernardino	10
Wilseyville	95257	Calaveras	12	Yucca Valley	92284	San Bernardino	14
Wilton	95693	Sacramento	12				
Winchester	92596	Riverside	10	Z			
Windsor	95492	Sonoma	2				
Winterhaven	92283	Imperial	15	Zamora	95698	Yolo	12

[Zenia](#)[95595](#)[Trinity](#)[2](#)

City	County	CZ	City	County	CZ
A			Alondra Park	Los Angeles	6
			Alpaugh	Tulare	13
			Alpine	San Diego	10
Abbotte Lagoon	Marin	3	Alta	Placer	16
Academy	Fresno	13	Alta-Loma	San Bernardino	10
Acampo	San Joaquin	12	Alta Sierra	Kern	16
Acolita	Imperial	15	Altadena	Los Angeles	9
Actis	Kern	14	Altamont	Alameda	12
Acton	Los Angeles	14	Altaville	Calaveras	12
Adelaida	San Luis Obispo	4	Alton	Humboldt	4
Adelanto	San Bernardino	14	Alturas	Modoc	16
Adin	Modoc	16	Alvise	Santa Clara	4
Adobe	Kern	13	Amador	Amador	12
Afton	San Bernardino	14	Amargosa Range	Inyo	14
Ager	Siskiyou	16	Amargosa River	Inyo	14
Agoura Hills	Los Angeles	9	Amboy	San Bernardino	15
Agua Caliente Canyon	Santa Barbara	5	Ambrose	Modoc	16
Agua Caliente Springs	San Diego	15	American Canyon	Napa	2
Agua Duice	Los Angeles	9	American River	Sacramento	12
Aguanga	Riverside	10	American River (Silver Fork)	El Dorado	16
Ahwahnee	Madera	13	Amos	Imperial	15
Airport Lake	Inyo	14	Anacapa Island	Ventura	6
Alameda	Alameda	3	Anaheim	Orange	8
Alamo	Contra Costa	12	Anchor Bay	Mendocino	4
Alamo River	Imperial	15	Anderson	Shasta	11
Albany	Alameda	3	Anderson Lake	Santa Clara	4
Alberhill	Riverside	10	Andrade	Imperial	15
Albion	Mendocino	4	Angel Island	Marin	3
Alderpoint	Humboldt	2	Angels Camp	Calaveras	12
Alhambra	Los Angeles	9	Angiola	Tulare	13
Alisal	Monterey	3	Angwin	Napa	2
Alisal Slough	Monterey	3	Annapolis	Sonoma	4
Aliso Canyon	Los Angeles	16	Antelope	Sacramento	12
Aliso Viejo	Orange	8	Antelope Center	Los Angeles	14
Alleghany	Sierra	16	Antelope Lake	Plumas	16
Allendale	Selene	12	Antelope Plain	Kern	13
Allensworth	Tulare	13	Antelope Valley	Los Angeles	14
Almaden A.F.S.	Santa Clara	4	Antioch	Contra Costa	12
Almanor	Plumas	16	Anza	Riverside	16

City	County	CZ	City	County	CZ
Apache Canyon	Ventura	16	Avalon	Los Angeles	6
Apple Valley	San Bernardino	14	Avawatz Mountains	San Bernardino	14
Applegate	Placer	11	Avenal	Kings	13
Aptos	Santa Cruz	3	Avila Beach	San Luis Obispo	5
Araz Wash	Imperial	15	Avocado Heights	Los Angeles	16
Arbuckle	Colusa	11	Azusa	Los Angeles	9
Arcadia	Los Angeles	9			
Arcata	Humboldt	4	B		
Arcata Bay	Humboldt	4			
Arden Town	Sacramento	12	Badger	Tulare	13
Argus	San Bernardino	14	Bagby	Mariposa	12
Argus Peak	Inyo	16	Bagdad	San Bernardino	15
Argus Range	Inyo	16	Baker	San Bernardino	14
Arlington	Riverside	10	Bakersfield	Kern	13
Armona	Kings	13	Balch	San Bernardino	14
Arnold	Calaveras	16	Bald Eagle Mountain	Plumas	16
Arnold	Mendocino	2	Baldwin Park	Los Angeles	9
Aromas	Monterey	3	Ballarat	Inyo	14
Arrowhead Junction	San Bernardino	14	Ballico	Merced	12
Arroyo Dos Picachos	San Benito	4	Bangor	Butte	11
Arroyo Grande	San Luis Obispo	5	Banning	Riverside	15
Arroyo Honda	Fresno	13	Banta	San Joaquin	12
Arroyo Honda	Santa Clara	4	Bard	Imperial	15
Arroyo Salada	Imperial	15	Bardsdale	Ventura	9
Arroyo Seco	Monterey	4	Barkerville	Lake	2
Artesia	Los Angeles	8	Barkley Mountain	Tehama	16
Artois	Glenn	11	Barona	San Diego	10
Arvin	Kern	13	Barrett Dam	San Diego	10
Ash Mountain	Tulare	13	Barrett Junction	San Diego	10
Ashland	Alameda	3	Barstow	San Bernardino	14
Aspen Valley	Tuolumne	16	Bartle	Siskiyou	16
Asti	Sonoma	2	Bartlett	Inyo	16
Atascadero	San Luis Obispo	4	Bartlett Springs	Lake	2
Atherton	San Mateo	3	Bass Lake	Madera	16
Athlone	Merced	12	Bassett	Los Angeles	9
Atolia	San Bernardino	14	Baxter	Placer	16
Atwater	Merced	12	Bayley	Modoc	16
Auberry	Fresno	13	Bayliss	Glenn	11
Auburn	Placer	11	Bayside	Humboldt	4
Auburn Ravine	Sutter	11	Baywood Park	San Luis Obispo	5
Aukum	El Dorado	12	Beale Air Force Base	Yuba	11

City	County	CZ	City	County	CZ
Bear Buttes	Humboldt	2	Bethel Island	Contra Costa	12
Bear River	Amador	16	Betteravia	Santa Barbara	5
Bear River	Humboldt	1	Beverly Hills	Los Angeles	9
Bear River	Sutter	11	Bieber	Lassen	16
Bear River	Yuba	11	Big Bar	Trinity	16
Bear Valley	Mariposa	12	Big Basin	Santa Cruz	3
Beardsley Lake	Tuolumne	16	Big Bear City	San Bernardino	16
Beaumont	Riverside	10	Big Bear Lake	San Bernardino	16
Beckwourth	Plumas	16	Big Bend	Butte	16
Beckwourth Pass	Lassen	16	Big Bend	Shasta	16
Beckwourth Pass	Plumas	16	Big Bend	Sonoma	2
Beegum	Shasta	11	Big Creek	Fresno	16
Belden	Plumas	16	Big Lagoon	Humboldt	1
Bell	Los Angeles	8	Big Lake	Shasta	16
Bell Gardens	Los Angeles	8	Big Maria Mountains	Riverside	15
Bell Mountain	San Bernardino	14	Big Mountains	Sonoma	2
Bell Mountain Wash	San Bernardino	14	Big Oak Flat	Tuolumne	12
Bell Springs	Mendocino	2	Big Pine	Inyo	16
Bell Station	Santa Clara	4	Big Pines	Los Angeles	16
Bella Vista	Shasta	11	Big Rock Wash	Los Angeles	14
Bellflower	Los Angeles	8	Big Sage Reservoir	Modoc	16
Bellota	San Joaquin	12	Big Springs	Siskiyou	16
Belmont	San Mateo	3	Big Sur	Monterey	4
Belvedere	Marin	3	Big Sur River (North Fork)	Monterey	4
Ben Hur	Mariposa	12	Big Tujungs Canyon	Los Angeles	16
Ben Lomond	Santa Cruz	3	Big Valley Mountains	Lassen	16
Benbow	Humboldt	2	Big Valley Mountains	Modoc	16
Bend	Tehama	11	Biggs	Butte	11
Benicia	Solano	12	Bijou	El Dorado	16
Bennetts Well	Inyo	14	Biola	Fresno	13
Benton	Mono	16	Birds Landing	Solano	12
Benton Hot Springs	Mono	16	Bishop	Inyo	16
Berenda	Madera	13	Bissell	Kern	14
Berkeley	Alameda	3	Bitterwater	San Benito	4
Berry Creek	Butte	11	Black Bear	Siskiyou	16
Berryessa	Santa Clara	4	Black Butte	Glenn	16
Berryessa Lake	Napa	2	Black Butte Reservoir	Glenn	11
Berryessa Peak	Napa	2/12	Black Butte Reservoir	Tehama	11
Berryessa Peak	Yolo	2/12	Black Butte River	Mendocino	16
Beswick	Siskiyou	16	Black Canyon Wash	San Bernardino	14
Bethany	San Joaquin	12	Black Meadow Landing	San Bernardino	15

City	County	CZ	City	County	CZ
Black Mountain	Fresno	13	Bowman	Placer	11
Black Point	Marin	2	Box Canyon	Riverside	15
Blackhawk	Contra Costa	12	Boyes Hot Springs	Sonoma	2
Blackwells Corner	Kern	13	Bradbury	Los Angeles	9
Blairsden	Plumas	16	Bradley	Monterey	4
Blocksburg	Humboldt	2	Brannan Island	Sacramento	12
Bloomfield	Sonoma	2	Branscomb	Mendocino	1
Bloomington	San Bernardino	10	Brant	San Bernardino	14
Blossom	Tehama	11	Brawley	Imperial	15
Blue Canyon	Placer	16	Bray	Siskiyou	16
Blue Lake	Humboldt	1	Brea	Orange	8
Blunt	Tehama	11	Breckenridge Mountain	Kern	16
Blythe	Riverside	15	Brentwood	Contra Costa	12
Boca	Nevada	16	Briceburg	Mariposa	12
Boca Reservoir	Nevada	16	Briceland	Humboldt	2
Bodega	Sonoma	1	Bridge House	Sacramento	12
Bodega Bay	Marin	3	Bridgeport	Mono	16
Bodega Bay	Sonoma	1	Bridgeport Reservoir	Mono	16
Bodega Head	Sonoma	1	Bridgeville	Humboldt	2
Bodfish	Kern	16	Brienes Reservoir	Contra Costa	12
Bodie	Mono	16	Brisbane	San Mateo	3
Bolam	Siskiyou	16	Bristol Lake	San Bernardino	15
Bolinas	Marin	3	Bristol Mountains	San Bernardino	14
Bollibokka Mountain	Shasta	16	Broderick	Yolo	12
Bolsa Knolls	Monterey	3	Brookdale	Santa Cruz	3
Bombay Beach	Imperial	15	Brooks Ranch	Yolo	12
Bonadella Ranches—Madera	Fresno	13	Brown	Kern	14
Bonanza King	Trinity	16	Browns Valley	Yuba	11
Bonds Corner	Imperial	15	Brownsville	Yuba	11
Bonita	Madera	13	Bruhel Point	Mendocino	1
Bonny Doon	Santa Cruz	3	Brush Creek	Butte	16
Bonsall	San Diego	10	Bryman	San Bernardino	14
Boonville	Mendocino	2	Bryson	Monterey	4
Boetjack	Mariposa	12	Bryte	Yolo	12
Boron	Kern	14	Buck Meadows	Mariposa	16
Borrego	San Diego	15	Buckeye	Shasta	11
Borrego Springs	San Diego	15	Buckhorn Lake	Kern	14
Bostonia	San Diego	10	Bucks Lake	Plumas	16
Boulder Creek	Santa Cruz	3	Budweiser Wash	San Bernardino	14
Boulevard	San Diego	14	Buellton	Santa Barbara	5
Bowles	Fresno	13	Buena Park	Orange	8

City	County	CZ	City	County	CZ
Buena Vista	Amador	12	Calders Corner	Kern	13
Buena Vista Lake Bed	Kern	13	Calexico	Imperial	15
Bull Creek	Humboldt	1	Calflax	Fresno	13
Bull Spring Wash	San Bernardino	14	Caliente	Kern	16
Bullion Mountains	San Bernardino	14	Caliente Range	San Luis Obispo	4
Buntingville	Lassen	16	California City	Kern	14
Burbank	Los Angeles	9	California Hot Springs	Tulare	16
Burbeck	Mendocino	2	California Valley	San Luis Obispo	4
Burdell	Marin	2	Calimesa	Riverside	10
Burlingame	San Mateo	3	Calipatria	Imperial	15
Burney	Shasta	16	Calistoga	Napa	2
Burney Mountain	Shasta	16	Callahan	Siskiyou	16
Burnt Ranch	Trinity	16	Calneva	Lassen	16
Burreliold	Fresno	13	Calpella	Mendocino	2
Burson	Calaveras	12	Calpine	Sierra	16
Butler Valley	Humboldt	1	Calwa	Fresno	13
Butte City	Glenn	11	Camanche Reservoir	Amador	12
Butte Meadows	Butte	16	Camanche Reservoir	Calaveras	12
Butte Valley	Siskiyou	16	Camarille	Ventura	6
Buttonwillow	Kern	13	Cambria	San Luis Obispo	5
Byron	Contra Costa	12	Cameron Park	El Dorado	12
C			Camine	El Dorado	12
			Camine	San Bernardino	14
			Camp Angelus	San Bernardino	16
Cabazon	Riverside	15	Camp Far West Reservoir	Yuba	11
Cabrillo National Monument	San Diego	7	Camp Meeker	Sonoma	2
Cachuma Lake	Santa Barbara	5	Camp Nelson	Tulare	16
Cadiz	San Bernardino	15	Camp Pardee	Calaveras	12
Cadiz Lake	San Bernardino	15	Camp Pendleton	San Diego	10
Cadiz Valley	San Bernardino	15	Camp Richardson	El Dorado	16
Cady Mountains	San Bernardino	14	Camp Roberts	Monterey	4
Cahto Peak	Mendocino	2	Campbell	Santa Clara	4
Cahuilla	Riverside	16	Campo	San Diego	14
Cajon Junction	San Bernardino	16	Campo Seco	Calaveras	12
Cajon Summit	San Bernardino	16	Camptonville	Yuba	16
Calabajas	Los Angeles	9	Canby	Modoc	16
Calada	San Bernardino	14	Canoga Park	Los Angeles	9
Calaveras Reservoir	Alameda	12/4	Cantil	Kern	14
Calaveras Reservoir	Santa Clara	12/4	Canyon Lake	Riverside	10
Calaveras River	San Joaquin	12	Canyondam	Plumas	16
Calaveritas	Calaveras	12	Capay	Yolo	12

City	County	CZ	City	County	CZ
Cape Mendocino	Humboldt	4	Cathays Valley	Mariposa	12
Cape San Martin	Monterey	4	Catlett	Sutter	11
Capetown	Humboldt	4	Cayton	Shasta	16
Capistrano Beach	Orange	6	Cayucos	San Luis Obispo	5
Capitan	Santa Barbara	6	Cazadero	Sonoma	4
Capitola	Santa Cruz	3	Cecilville	Siskiyou	16
Caples Lake	Alpine	16	Cedar Grove	Fresno	16
Carbona	San Joaquin	12	Cedar Ridge	Nevada	11
Carbondale	Amador	12	Cedar Wash	San Bernardino	14
Cardiff-by-the-Sea	San Diego	7	Cedarville	Modoc	16
Caribou	Plumas	16	Centerville	Fresno	13
Carlotta	Humboldt	4	Centerville	Humboldt	4
Carlsbad	San Diego	7	Centerville	Shasta	11
Carmel Highlands	Monterey	3	Centerville Power House	Butte	11
Carmel Valley	Monterey	3	Central Valley	Shasta	11
Carmel-by-the-Sea	Monterey	3	Ceres	Stanislaus	12
Carmichael	Sacramento	12	Cerritos	Los Angeles	8
Carnelian Bay	Placer	16	Cerro Alto	San Luis Obispo	4
Carpinteria	Santa Barbara	6	Cerro Gordo Peak	Inyo	16
Carr Butte	Modoc	16	Chalfant	Mono	16
Carrizo Plain	San Luis Obispo	4	Challenge	Yuba	16
Carrizo Wash	Imperial	15	Chambless	San Bernardino	15
Carrville	Trinity	16	Chanchelulla Peak	Trinity	16
Carson	Los Angeles	6	Charter Oak	Los Angeles	9
Carson River (East Fork)	Alpine	16	Chatsworth	Los Angeles	9
Carson River (West Fork)	Alpine	16	Chemurgie	Stanislaus	12
Cartago	Inyo	16	Cherokee	Butte	11
Caruthers	Fresno	13	Cherry Lake	Tuolumne	16
Casa de Oro, Mount Helix	San Diego	10	Cherry Valley	Riverside	10
Cascade Range	Siskiyou	16	Cherryland	Alameda	3
Casitas Springs	Ventura	9	Chester	Plumas	16
Casmalia	Santa Barbara	5	Chicago Park	Nevada	11
Caspar	Mendocino	4	Chico	Butte	11
Cassel	Shasta	16	Chidago Canyon	Mono	16
Castaic	Los Angeles	9	Chilcoot	Plumas	16
Castella	Shasta	16	China Lake	Kern	14
Castle Air Force Base	Merced	12	China Lake	San Bernardino	14
Castro Valley	Alameda	3	China Peak	Trinity	16
Castroville	Monterey	3	Chinese Camp	Tuolumne	12
Caswell	Los Angeles	16	Chino	San Bernardino	10
Cathedral City	Riverside	15	Chino Hills	San Bernardino	10

City	County	CZ	City	County	CZ
Chiriaco Summit	Riverside	14	Coachella Valley	Riverside	15
Chloride City	Inyo	16	Coalinga	Fresno	13
Cholame	San Luis Obispo	4	Coarsegold	Madera	13
Cholame Hills	Monterey	4	Cobb	Lake	2
Chowchilla	Madera	13	Coburn	Monterey	4
Chowchilla Canal	Madera	13	Codera	Glenn	11
Chrome	Glenn	11	Cohasset	Butte	11
Chualar	Monterey	3	Cold Springs	Tuolumne	16
Chubbuck	San Bernardino	15	Coleville	Mono	16
Chuckwalla Mountains	Riverside	14	Colfax	Placer	11
Chuckwalla Valley	Riverside	15	College City	Colusa	11
Chula Vista	San Diego	7	Collegeville	San Joaquin	12
Cima	San Bernardino	14	Collierville	San Joaquin	12
Cisco	Placer	16	Collinsville	Solano	12
Citrus Heights	Sacramento	12	Colma	San Mateo	3
City Terrace	Los Angeles	9	Coloma	El Dorado	12
Clair Engle Lake	Trinity	16	Colorado River	San Bernardino	15
Claraville	Kern	16	Colton	San Bernardino	10
Claremont	Los Angeles	9	Columbia	Tuolumne	12
Clark Mountain	San Bernardino	14	Colusa	Colusa	11
Clarksburg	Yolo	12	Colusa Basin Drainage Canal	Yolo	12
Clarkeville	El Dorado	12	Colusa Trough	Colusa	11
Clavey River	Tuolumne	16	Commerce	Los Angeles	8
Clay	Sacramento	12	Comptche	Mendocino	4
Clayton	Contra Costa	12	Compton	Los Angeles	8
Clear Creek	Lassen	16	Concepcion	Santa Barbara	6
Clear Lake Reservoir	Modoc	16	Concord	Contra Costa	12
Clearlake	Lake	2	Condroy Mountain	Siskiyou	16
Clearlake Highlands	Lake	2	Conejo	Fresno	13
Clearlake Oaks	Lake	2	Conner	Kern	13
Clearlake Park	Lake	2	Constantia	Lassen	16
Clements	San Joaquin	12	Cooks Station	Amador	16
Cleone	Mendocino	4	Coel	El Dorado	12
Clio	Plumas	16	Copee	Siskiyou	16
Clipper Gap	Placer	11	Copperopolis	Calaveras	12
Clipper Mills	Butte	16	Corcoran	Kings	13
Cloverdale	Shasta	11	Corcoran Reservoir	Kings	13
Cloverdale	Sonoma	2	Cordelia	Solano	12
Clovis	Fresno	13	Cornell	Los Angeles	6
Clyde	Imperial	15	Cornell	Modoc	16
Coachella	Riverside	15	Corning	Tehama	11

City	County	CZ	City	County	CZ
Corning Canal	Tehama	11	Creston	San Luis Obispo	4
Corona	Riverside	10	Crestview	Mono	16
Corona-Del-Mar	Orange	6	Crockett	Contra-Costa	12
Coronado	San-Diego	7	Cromberg	Plumas	16
Corral Hollow	Alameda	12	Cross-Roads	San-Bernardino	15
Corral Hollow	San-Joaquin	12	Crows-Landing	Stanislaus	12
Corralitos	Santa-Cruz	3	Crucero	San-Bernardino	14
Corte-Madera	Marin	2	Crystal-Springs-Reservoir	San-Mateo	3
Coso-Hot-Springs	Inyo	16	Cucamonga	San-Bernardino	10
Coso-Junction	Inyo	16	Cudahy	Los-Angeles	8
Coso-Peak	Inyo	16	Cuddeback-Lake	San-Bernardino	14
Coso-Range	Inyo	16	Cuddy-Canyon	Kern	16
Costa-Mesa	Orange	6	Cuddy-Canyon	Ventura	16
Cosumnes-River	Sacramento	12	Cuesta-Pass	San-Luis-Obispo	4
Cotati	Sonoma	2	Culver-City	Los-Angeles	8
Coto-De-Caza	Orange	8	Cummings	Mendocino	2
Cottage-Grove	Siskiyou	16	Cunningham	Sonoma	2
Cottonwood	Shasta	11	Cupertino	Santa-Clara	4
Cottonwood-Canyon	Inyo	14/16	Curtis	Siskiyou	16
Cottonwood-Mountains	Inyo	16	Cutler	Tulare	13
Cottonwood-Wash	San-Bernardino	14	Cutten	Humboldt	1
Cougar	Siskiyou	16	Cuyama	Santa-Barbara	4
Coulterville	Mariposa	12	Cuyama-Valley	San-Luis-Obispo	4
Country-Club	San-Joaquin	12	Cuyama-Valley	Santa-Barbara	4
Courtland	Sacramento	12	Cuyamaca	San-Diego	7
Courtright-Reservoir	Fresno	16	Cuyamaca-Peak	San-Diego	14
Covele	Mendocino	2	Cypress	Orange	8
Covina	Los-Angeles	9			
Covington-Mill	Trinity	16	D		
Cow-Head-Lake	Modoc	16			
Cowtrack-Mountain	Mono	16	Daggett	San-Bernardino	14
Coyote	Santa-Clara	4	Dairyland	Madera	13
Coyote-Lake	San-Bernardino	14	Dairyville	Tehama	11
Coyote-Wash	Imperial	15	Dale-Lake	San-Bernardino	14
Cranmore	Sutter	11	Dales	Tehama	11
Crannell	Humboldt	1	Dalton	Modoc	16
Crater-Mountain	Lassen	16	Daly-City	San-Mateo	3
Crescent-City	Del-Norte	1	Dana	Shasta	16
Crescent-Mills	Plumas	16	Dana-Point	Orange	6
Cressey	Merced	12	Danby	San-Bernardino	14
Crestline	San-Bernardino	16	Danby-Lake	San-Bernardino	15

City	County	CZ	City	County	CZ
Danville	Contra Costa	42	Denverton	Solano	42
Dardanelle	Tuolumne	46	Derby Acres	Kern	43
Darrah	Mariposa	42	Descanso	San Diego	44
Darwin	Inyo	46	Desert	San Bernardino	44
Darwin Wash	Inyo	46	Desert Beach	Riverside	45
Daulton	Madera	43	Desert Center	Riverside	45
Davenport	Santa Cruz	3	Desert Hot Springs	Riverside	45
Davis	Yolo	42	Desert Shores	Imperial	45
Davis Creek	Modoc	46	Desert View Highland	Los Angeles	44
Dawes	San Bernardino	14	Devils Canyon	Los Angeles	46
Day	Modoc	46	Devils Den	Kern	43
Dayton	Butte	44	Devils Playground	San Bernardino	44
De Luz	San Diego	40	Devils Playground Wash	San Bernardino	44
De Sabla	Butte	44	Devere	San Bernardino	40
Deadwood	Trinity	46	Di-Giorgio	Kern	43
Death Valley	Inyo	44	Diablo	Contra Costa	42
Death Valley Junction	Inyo	44	Diablo Range	Santa Clara	4
Death Valley Wash	Inyo	44	Diamond Bar	Los Angeles	9
Dedrick	Trinity	46	Diamond Mountains	Lassen	46
Deep Canyon	Riverside	45	Diamond Mountains	Plumas	46
Deep Springs	Inyo	46	Diamond Springs	El Dorado	42
Deep Springs Lake	Inyo	46	Dillon Beach	Marin	3
Deep Water Ship Channel	Solano	42	Dinkey Creek	Fresno	46
Deep Water Ship Channel	Yolo	42	Dinsmores	Humboldt	2
Deer Creek Power House	Nevada	46	Dinuba	Tulare	43
Deetz	Siskiyou	46	Discovery Bay	Contra Costa	42
Del Aire	Los Angeles	6	Dixie Mountain	Plumas	46
Del Dios	San Diego	40	Dixieland	Imperial	45
Del Loma	Trinity	46	Dixon	Solano	42
Del Mar	San Diego	7	Dobbins	Yuba	44
Del Paso Heights	Sacramento	42	Dolomite	Inyo	46
Del Rey	Fresno	43	Dominguez	Los Angeles	8
Del Rey Oaks	Monterey	3	Donner Pass	Nevada	46
Del Rosa	San Bernardino	46	Donner Pass	Placer	46
Delane	Kern	43	Dorrington	Calaveras	46
Delevan	Colusa	44	Dorrie	Siskiyou	46
Delhi	Merced	42	Des Gabezas	San Diego	45
Delleker	Plumas	46	Des Palos	Merced	42
Delta	Shasta	46	Des Ries	Mendocino	2
Denair	Stanislaus	42	Douglas City	Trinity	46
Denny	Trinity	46	Downey	Los Angeles	8

City	County	CZ	City	County	CZ
Downie River	Sierra	46	East Hemet	Riverside	40
Downioville	Sierra	46	East Highlands	San Bernardino	40
Doyle	Lassen	46	East Irvine	Orange	8
Dozler	Solano	42	East La Mirada	Los Angeles	9
Drake	Santa Barbara	6	East Los Angeles	Los Angeles	9
Drakes Bay	Marin	3	East Mesa	Imperial	45
Drakes Estero	Marin	3	East Nicolaus	Sutter	44
Drakesbad	Plumas	46	East Palo Alto	San Mateo	3
Dry Canyon	Ventura	46	East Park Reservoir	Colusa	44
Drytown	Amador	42	East Pasadena	Los Angeles	16
Duarte	Los Angeles	9	East Porterville	Tulare	43
Dublin	Alameda	42	East Quincy	Plumas	46
Ducor	Tulare	43	East San Gabriel	Los Angeles	9
Dudleys	Mariposa	42	East Walker River	Mono	46
Dugwynos Canyon	San Diego	45	East Whittier	Los Angeles	9
Dulzura	San Diego	40	Easton	Fresno	43
Duncan Canyon	Placer	46	Ebbetts Pass	Alpine	46
Duncans Mills	Sonoma	4	Echo	Mendocino	2
Dunlap	Fresno	43	Echo Canyon	Inyo	44
Dunmavin	Inyo	46	Echo Lake	El Dorado	46
Dunnigan	Yolo	42	Echo Summit	El Dorado	46
Dunsmuir	Siskiyou	46	Eder	Placer	46
Durham	Butte	44	Edgemont	Riverside	40
Durmid	Riverside	45	Edgewood	Siskiyou	46
Dutch Flat	Placer	46	Edison	Kern	43
Duttons Landing	Napa	2	Edna	San Luis Obispo	5
Dwinnell Reservoir	Siskiyou	46	Edwards Air Force Base	Kern	44
E			Eel Rock	Humboldt	2
			El Cajon	San Diego	40
			El Capitan Reservoir	San Diego	44
Eagle Crags	San Bernardino	44	El Centro	Imperial	45
Eagle Lake	Lassen	46	El Cerrito	Contra Costa	3
Eagle Lake Resort	Lassen	46	El Dorado	El Dorado	42
Eagle Mountain	Riverside	44	El Dorado Hills	El Dorado	42
Eagle Mountains	Riverside	44	El Granada	San Mateo	3
Eagle Peak	Modoc	46	El Mirage	San Bernardino	44
Eagleville	Modoc	46	El Mirage Lake	San Bernardino	44
Earlimart	Tulare	43	El Monte	Los Angeles	9
Earp	San Bernardino	45	El Nido	Merced	42
East Biggs	Butte	44	El Paso de Robles	San Luis Obispo	4
East Compton	Los Angeles	8	El Paso Mountains	Kern	44

City	County	CZ	City	County	CZ
El Portal	Mariposa	16	Etna	Siskiyou	16
El Rio	Ventura	6	Etsel Ridge	Mendocino	16
El Segundo	Los Angeles	6	Ettersburg	Humboldt	1
El Sobrante	Contra Costa	3	Eugene	Stanislaus	12
El Toro	Orange	8	Eureka	Humboldt	1
El Verano	Sonoma	2	Eureka Valley	Inyo	16
Elders Corner	Placer	11	Exeter	Tulare	13
Elderwood	Tulare	13			
Electra Power House	Amador	12	F		
Elizabeth Lake Canyon	Los Angeles	16			
Elk	Mendocino	1	Fair Oaks	Sacramento	12
Elk Bayou	Tulare	13	Fairfax	Marin	2
Elk Creek	Glenn	11	Fairfield	Solano	12
Elk Grove	Sacramento	12	Fairmead	Madera	13
Elk River	Humboldt	1	Fairmont	Los Angeles	14
Elk River (North Fork)	Humboldt	1	Fairview	Tulare	16
Elk River (South Fork)	Humboldt	1	Fairville	Sonoma	2
Elk Valley	Del Norte	16	Fales Hot Springs	Mono	16
Elkhorn Slough	Monterey	3	Falk	Humboldt	1
Elmira	Solano	12	Fall River	Shasta	16
Elsinore	Riverside	10	Fall River Mills	Shasta	16
Elverta	Sacramento	12	Fallbrook	San Diego	10
Emerald Bay	Orange	6	Fallen Leaf Lake	El Dorado	16
Emerson Lake	San Bernardino	14	Fallon	Marin	3
Emeryville	Alameda	3	Famoso	Kern	13
Emigrant Canyon	Inyo	16	Fandango Pass	Modoc	16
Emigrant Gap	Placer	16	Farallon Island	San Francisco	1
Empire	Stanislaus	12	Farmersville	Tulare	13
Encanto	San Diego	10	Farmington	San Joaquin	12
Encinitas	San Diego	7	Fawnskin	San Bernardino	16
Encino	Los Angeles	9	Feather Falls	Butte	16
Enterprise	Shasta	11	Feather River	Sutter	11
Erickson	Siskiyou	16	Feather River (Middle Fork)	Butte	16
Escalon	San Joaquin	12	Feather River (North Fork)	Butte	16
Escondido	San Diego	10	Fellows	Kern	13
Esparto	Yolo	12	Felton	Santa Cruz	3
Essex	San Bernardino	14	Fenner	San Bernardino	14
Estero Bay	San Luis Obispo	5	Fenner Valley	San Bernardino	14
Estrella	San Luis Obispo	4	Ferguson Lake	Imperial	15
Estrella River	San Luis Obispo	4	Fern	Shasta	11
Etiwanda	San Bernardino	14	Fernbridge	Humboldt	1

City	County	CZ	City	County	CZ
Fernbrook	San Diego	40	Fort Jones	Siskiyou	46
Ferndale	Humboldt	4	Fort MacArthur	San Diego	7
Fiddletown	Amador	42	Fort Ord	Monterey	3
Fieldbrook	Humboldt	4	Fort Ross	Sonoma	4
Fields Landing	Humboldt	4	Fort Seward	Humboldt	2
Figarden	Fresno	43	Fortuna	Humboldt	4
Fillmore	Ventura	9	Fossil Canyon	San Bernardino	44
Finley	Lake	2	Foster City	San Mateo	3
Firebaugh	Fresno	43	Fountain Springs	Tulare	43
Fish Camp	Mariposa	46	Fountain Springs Gulch	Tulare	43
Fish Springs	Inyo	46	Fountain Valley	Orange	6
Five Points	Fresno	43	Fourth Crossing	Calaveras	42
Fleming Fish & Game	Lassen	46	Fouts Springs	Colusa	44
Fletcher	Modoc	46	Fowler	Fresno	43
Florence	Los Angeles	8	Foxen Canyon	Santa Barbara	5
Florence Lake	Fresno	46	Franklin	Sacramento	42
Florence Peak	Tulare	46	Franklin Well	Inyo	44
Florin	Sacramento	42	Frazier Mountain	Ventura	46
Floriston	Nevada	46	Frazier Park	Kern	46
Flournoy	Tehama	44	Fredonyer Peak	Lassen	46
Flynn	San Bernardino	44	Freedom	Santa Cruz	3
Folsom	Sacramento	42	Freel Peak	Alpine	46
Fontana	San Bernardino	40	Freel Peak	El Dorado	46
Foothill Farms	Sacramento	42	Freeman Junction	Kern	44
Forbestown	Butte	46	Freeport	Sacramento	42
Ford City	Kern	43	Freestone	Sonoma	2
Ford Dry Lake	Riverside	45	Fremont	Alameda	3
Forest	Sierra	46	Fremont Peak	San Bernardino	44
Forest Falls	San Bernardino	46	Fremont Valley	Kern	44
Forest Glen	Trinity	46	Fremont Wash	San Bernardino	44
Forest Hill Divide	Placer	46	French Camp	San Joaquin	42
Forest Knolls	Marin	2	French Corral	Nevada	44
Forest Ranch	Butte	44	French Gulch	Shasta	44
Foresthill	Placer	46	Frenchman Lake	Plumas	46
Forestville	Sonoma	2	Freshwater	Humboldt	4
Forks of Salmon	Siskiyou	46	Fresno	Fresno	43
Fort Baker	Marin	3	Fresno Slough	Fresno	43
Fort Bidwill	Modoc	46	Friant	Fresno	43
Fort Bragg	Mendocino	4	Friant Dam	Madera	43
Fort Dick	Del Norte	4	Fried Liver Wash	Riverside	44
Fort Goff	Siskiyou	46	Frink	Imperial	45

City	County	CZ	City	County	CZ
Frute	Glenn	11	Glencoe	Calaveras	12
Fullerton	Orange	8	Glendale	Los Angeles	9
Fulton	Sonoma	2	Glendora	Los Angeles	9
Funeral Park	Inyo	14	Glenhaven	Lake	2
Furnace Creek Wash	Inyo	14	Glenn	Glenn	11
G			Glenn Colusa Canal	Colusa	11
			Glennville	Kern	16
			Goffs	San Bernardino	14
Galt	Sacramento	12	Gold Canyon	Kern	16
Ganns	Calaveras	16	Gold Rock Rch	Imperial	15
Garberville	Humboldt	2	Gold Run	Placer	16
Garden Acres	San Joaquin	12	Golden Gate	Marin	3
Garden Grove	Orange	8	Golden Gate	San Francisco	3
Garden Valley	El Dorado	12	Golden Hills	Kern	16
Gardena	Los Angeles	8	Goldstone	San Bernardino	14
Garey	Santa Barbara	5	Goldstone Lake	San Bernardino	14
Garlock	Kern	14	Goleta	Santa Barbara	6
Gas Point	Shasta	11	Gonzales	Monterey	3
Gasquet	Del Norte	16	Goodyears Bar	Sierra	16
Gaviota	Santa Barbara	6	Goose Lake	Modoc	16
Gaviota Pass	Santa Barbara	6	Goosenest	Siskiyou	16
Gazelle	Siskiyou	16	Gorda	Monterey	3
Genesee	Plumas	16	Gordon Mountain	Del Norte	16
George A.F.B.	San Bernardino	14	Gordons Well	Imperial	15
Georgetown	El Dorado	12	Gorman	Los Angeles	16
Gerber	Tehama	11	Goshen	Tulare	13
Geyserville	Sonoma	2	Goumaz	Lassen	16
Giant Forest	Tulare	16	Granada Hills	Los Angeles	9
Gibson Peak	Trinity	16	Grand Terrace	San Bernardino	10
Gibsonville	Sierra	16	Grangeville	Kings	13
Gillespie Field	Solano	12	Granite Bay	Placer	11
Gillman Hot Springs	Riverside	10	Granite Chief	Placer	16
Gilroy	Santa Clara	4	Granite Mountains	San Bernardino	14
Girvan	Shasta	11	Graniteville	Nevada	16
Glacier	Inyo	16	Grant Grove	Tulare	16
Glamis	Imperial	15	Grant Lake	Mono	16
Glasgow	San Bernardino	14	Grapovine	Kern	13
Glass Mountain	Mono	16	Grass Lake	Siskiyou	16
Glen Avon	Riverside	10	Grass Valley	Nevada	11
Glen Ellen	Sonoma	2	Graton	Sonoma	2
Glenburg	Shasta	16	Grayson	Stanislaus	12

City	County	CZ	City	County	CZ
Green Valley	Los Angeles	16	Hales Grove	Mendocino	1
Green Valley Lake	San Bernardino	16	Half Dome	Mariposa	16
Greenacres	Kern	13	Half Moon Bay	San Mateo	3
Greenfield	Kern	13	Halloran Springs	San Bernardino	14
Greenfield	Monterey	4	Halls Flat	Lassen	16
Greenhorn Mountains	Kern	16	Hambone	Siskiyou	16
Greenhorn Mountains	Tulare	16	Hamburg	Siskiyou	16
Greenview	Siskiyou	16	Hamilton A.F.B.	Marin	2
Greenville	Plumas	16	Hamilton City	Glenn	11
Greenwater Range	Inyo	14	Hammonton	Yuba	11
Greenwood	El Dorado	12	Hanford	Kings	13
Greenwood	Glenn	11	Happy Camp	Siskiyou	16
Grenada	Siskiyou	16	Harbinson Canyon	San Diego	10
Gridley	Butte	11	Harbor City	Los Angeles	8
Grimes	Colusa	11	Harden Flat	Tuolumne	16
Grizzly Bay	Solano	12	Hardwick	Kings	13
Grizzly Flat	El Dorado	16	Harmony	San Luis Obispo	5
Grommet	San Bernardino	15	Harper Lake	San Bernardino	14
Grossmont	San Diego	7	Harris	Humboldt	2
Grouse Mountain	Modoc	16	Hart	San Bernardino	14
Groveland	Tuolumne	12	Hat Creek	Shasta	16
Grover Beach	San Luis Obispo	5	Hathaway Pines	Calaveras	16
Grover City	San Luis Obispo	5	Havasu Lake	San Bernardino	15
Grover Hot Springs	Alpine	16	Havilah	Kern	16
Guadalupe	Santa Barbara	5	Hawaiian Gardens	Los Angeles	8
Gualala	Mendocino	4	Hawes	San Bernardino	14
Gualala River (South Fork)	Mendocino	4	Hawkinsville	Siskiyou	16
Guatay	San Diego	14	Hawthorne	Los Angeles	8
Guerneville	Sonoma	2	Hayden Hill	Lassen	16
Guernsey	Kings	13	Hayfield	Riverside	14
Guinda	Yolo	12	Hayfield Lake	Riverside	14
Gulf of the Farallones	Marin	3	Hayfork	Trinity	16
Gulf of the Farallones	San Francisco	3	Hayfork Bally	Trinity	16
Gustine	Merced	12	Hayward	Alameda	3
H			Healdsburg	Sonoma	2
			Hearst	Mendocino	2
			Heber	Imperial	15
Hacienda	Sonoma	2	Hector	San Bernardino	14
Hacienda Heights	Los Angeles	9	Helena	Trinity	16
Hackamore	Modoc	16	Holendale	San Bernardino	14
Haiwee Reservoir	Inyo	16	Holm	Fresno	13

City	County	CZ	City	County	CZ
Hemet	Riverside	40	Holtville	Imperial	45
Henderson Village	San Joaquin	42	Home Gardens	Riverside	40
Henleyville	Tehama	44	Homeland	Riverside	40
Henshaw Dam	San Diego	40	Homer	San Bernardino	44
Herald	Sacramento	42	Homer Wash	San Bernardino	44
Hercules	Contra Costa	3	Homewood	Placer	46
Herlong	Lassen	46	Honcut	Butte	44
Hermosa Beach	Los Angeles	6	Honda	Santa Barbara	5
Herndon	Fresno	43	Honey Lake	Lassen	46
Hesperia	San Bernardino	44	Honeydew	Humboldt	4
Hetch Hetchy Junction	Tuolumne	42	Honker Bay	Selma	42
Hetch Hetchy Reservoir	Tuolumne	46	Hood	Sacramento	42
Hi-Vista	Los Angeles	44	Hooker	Tehama	44
Hickman	Stanislaus	42	Hoopa	Humboldt	2
Hidden Hills	Los Angeles	9	Hopeton	Merced	42
Hidden Springs	Los Angeles	46	Hopland	Mendocino	2
Hidden Valley	Placer	44	Hornbrook	Siskiyou	46
Higgins Corner	Nevada	44	Hornites	Mariposa	42
High Peak	Glenn	44	Horse Creek	Siskiyou	46
Highgrove	Riverside	40	Horse Flat	Del Norte	46
Highland	San Bernardino	40	Horse Lake	Lassen	46
Highland Park	Los Angeles	9	Hotlum	Siskiyou	46
Highland Peak	Alpine	46	Huasna	San Luis Obispo	5
Highway City	Fresno	43	Huasna River	San Luis Obispo	5
Hillcrest Center	Kern	46	Hughson	Stanislaus	42
Hills Ferry	Stanislaus	42	Humboldt Bay	Humboldt	4
Hillsborough	San Mateo	3	Hume	Fresno	46
Hilmar	Merced	42	Humphreys Station	Fresno	43
Hilt	Siskiyou	46	Huntington Beach	Orange	6
Hinkley	San Bernardino	44	Huntington Lake	Fresno	46
Hiouchi	Del Norte	4	Huntington Park	Los Angeles	8
Hobart Mills	Nevada	46	Hupa Mountain	Humboldt	4
Hobergs	Lake	2	Huron	Fresno	43
Hodge	San Bernardino	44	Hyampom	Trinity	46
Hog Canyon	San Luis Obispo	4	Hydesville	Humboldt	4
Hollenbeck	Modoc	46			
Hollister	San Benito	4			
Hollywood	Los Angeles	9			
Hollywood-by-the-Sea	Ventura	6	Idlewild	Del Norte	4
Holmes	Humboldt	4	Idria	San Benito	4
Holt	San Joaquin	42	Idyllwild	Riverside	46

City	County	CZ	City	County	CZ
Igo	Shasta	44			
Imperial	Imperial	45	Jackson	Amador	42
Imperial Beach	San Diego	7	Jackson Meadows Reservoir	Nevada	46
Imperial Dam	Imperial	45	Jackson Meadows Reservoir	Sierra	46
Imperial Reservoir	Imperial	45	Jacksonville	Tuolumne	42
Imperial Valley	Imperial	45	Jacumba	San Diego	44
Inca	Riverside	45	Jacumba Mountains	San Diego	45
Independence	Inyo	46	Jalama	Santa Barbara	5
Indian Wells	Riverside	45	Jamesan	Fresno	43
Indian Wells Valley	Kern	14	Jamesburg	Monterey	4
Indio	Riverside	45	Jamestown	Tuolumne	42
Industry	Los Angeles	9	Jamul	San Diego	40
Ingleneek	Mendocino	4	Janesville	Lassen	46
Inglewood	Los Angeles	8	Jasmin	Kern	43
Ingomar	Merced	42	Java	San Bernardino	45
Ingot	Shasta	44	Jellico	Lassen	46
Inskip	Butte	46	Jenner	Sonoma	4
Inskip Hill	Tehama	44	Jenny Lind	Calaveras	42
Inverness	Marin	3	Jerome	Siskiyou	46
Inwood	Shasta	44	Jess Valley	Modoc	46
Inyo Mountains	Inyo	46	Jimtown	Sonoma	2
Inyokern	Kern	14	Johannesburg	Kern	44
Ione	Amador	42	John Wayne AP	Orange	6
Iowa Hill	Placer	46	Johnsendale	Tulare	46
Iris	Imperial	45	Johnsons	Humboldt	4
Irish Hills	San Luis Obispo	5	Johnstonville	Lassen	46
Iron Mountain	Shasta	44	Johnsville	Plumas	46
Irvine	Orange	8	Jolon	Monterey	4
Irwin	Merced	42	Jonesville	Butte	46
Irwindale	Los Angeles	9	Josephine	Sutter	44
Isabella Reservoir	Kern	46	Joshua Tree	San Bernardino	44
Isla Vista	Santa Barbara	6	Julian	San Diego	44
Island Mountain	Trinity	2	Junction City	Trinity	46
Isleton	Sacramento	42	June Lake	Mono	46
Ivanhoe	Tulare	43	Juniper Hills	Los Angeles	44
Ivanpah	San Bernardino	44	Junipero Serra Peak	Monterey	4
Ivanpah Lake	San Bernardino	44			
Ivanpah Valley	San Bernardino	44			
Ivesta	Fresno	43			
			Kaiser Peak	Fresno	46
J			Kandra	Modoc	46

City	County	CZ	City	County	CZ
Karlo	Lassen	16	Kismet	Madera	13
Kaweah	Tulare	13	Klamath	Del Norte	4
Kaweah River (Middle Fork)	Tulare	16	Klamath Glen	Del Norte	4
Kearsarge	Inyo	16	Klamath Mountains	Siskiyou	16
Kecks Corner	Kern	13	Klamath River	Siskiyou	16
Keddie	Plumas	16	Klamathon	Siskiyou	16
Keddie Ridge	Plumas	16	Klondike	San Bernardino	14
Keeler	Inyo	16	Kneeland	Humboldt	4
Keene	Kern	16	Knights Ferry	Stanislaus	12
Kekawaka	Trinity	2	Knights Landing	Yolo	12
Kelsey	El Dorado	12	Knightsen	Contra Costa	12
Kelseyville	Lake	2	Knob	Shasta	16
Kelso	San Bernardino	14	Knowles	Madera	13
Kelso Wash	San Bernardino	14	Knoxville	Napa	2
Kentfield	Marin	2	Koehn Lake	Kern	14
Kenwood	Sonoma	2	Korbel	Humboldt	4
Keough Hot Springs	Inyo	16	Kramer Junction	San Bernardino	14
Kephart	Modoc	16	Kyburz	El Dorado	16
Kerman	Fresno	13			
Kern River (South Fork)	Kern	16	L		
Kern River Channel	Kings	13			
Kernville	Kern	16	L.L. Anderson Reservoir	Placer	16
Keswick	Shasta	11	La Barr	Nevada	11
Kettenpom	Trinity	2	La Canada Flintridge	Los Angeles	9
Kettleman City	Kings	13	La Crescenta	Los Angeles	9
Kettleman Hills	Kings	13	La Grange	Stanislaus	12
Keyes	Stanislaus	12	La Habra	Orange	9
King City	Monterey	4	La Habra Heights	Los Angeles	9
King Range	Humboldt	4	La Honda	San Mateo	3
Kings Beach	Placer	16	La Jolla	San Diego	7
Kings River	Fresno	13	La Mesa	San Diego	7
Kings River	Kings	13	La Mirada	Los Angeles	9
Kings River (Middle Fork)	Fresno	16	La Palma	Orange	8
Kings River (North Fork)	Fresno	16	La Panza Range	San Luis Obispo	4
Kings River (South Fork)	Fresno	16	La Porte	Plumas	16
Kingsburg	Fresno	13	La Puente	Los Angeles	9
Kingston Peak	San Bernardino	14	La Quinta	Riverside	15
Kingston Wash	San Bernardino	14	La Riviera	Sacramento	12
Kinyon	Siskiyou	16	La Selva Beach	Santa Cruz	3
Kirkville	Sutter	11	La Verne	Los Angeles	9
Kirkwood	Sutter	11	La Vina	Madera	13

City	County	CZ	City	County	CZ
Ladera Heights	Los Angeles	9	Lakeport	Lake	2
Lafayette	Contra-Costa	12	Lakeshore	Fresno	16
Laguna Beach	Orange	6	Lakeside	San Diego	10
Laguna Dam	Imperial	15	Lakeview	Kern	13
Laguna Hills	Orange	6/8	Lakeview	Riverside	10
Laguna Niguel	Orange	6	Lakeville	Sonoma	2
Lake Almanor	Plumas	16	Lakewood	Los Angeles	8
Lake Alpine	Alpine	16	Lamoine	Shasta	16
Lake Arrowhead	San Bernardino	16	Lamont	Kern	13
Lake Berryessa	Napa	2	Lanare	Fresno	13
Lake Britton	Shasta	16	Lancaster	Los Angeles	14
Lake Cachuma	Santa Barbara	5	Landers	San Bernardino	14
Lake Casitas	Ventura	9	Lane Mountain	San Bernardino	14
Lake City	Modoc	16	Lanfair Valley	San Bernardino	14
Lake Crowley	Mono	16	Larksfield-Wikiup	Sonoma	2
Lake Davis	Plumas	16	Larkspur	Marin	2
Lake Del Valley	Alameda	12	Las Cruces	Santa Barbara	5
Lake Earl	Del Norte	1	Las Flores	San Diego	7
Lake Eleanor	Tuolumne	16	Las Plumas	Butte	11
Lake Elsinore	Riverside	10	Lassen Peak	Shasta	16
Lake Forest	Orange	8	Last Chance Canyon	Kern	14
Lake Havasu	San Bernardino	15	Last Chance Range	Inyo	16
Lake Henessey	Napa	2	Lathrop	San Joaquin	12
Lake Henshaw	San Diego	14	Laton	Fresno	13
Lake Isabella	Kern	16	Latrobe	El Dorado	12
Lake Kaweah	Tulare	13	Lava Beds	Modoc	16
Lake Los Angeles	Los Angeles	14	Lavic	San Bernardino	14
Lake Mathews	Riverside	10	Lavic Lake	San Bernardino	14
Lake McClure	Mariposa	12	Lawndale	Los Angeles	8
Lake Mendocino	Mendocino	2	Laws	Inyo	16
Lake Mountain	Siskiyou	16	Le Grand	Merced	12
Lake Oroville	Butte	11	Leach Lake	San Bernardino	14
Lake Perris	Riverside	10	Leavitt	Lassen	16
Lake Pillsbury	Lake	2	Leavitt Peak	Mono	16
Lake Spaulding	Nevada	16	Leavitt Peak	Tuolumne	16
Lake Success	Tulare	13	Lobee	Kern	16
Lake Tahoe	El Dorado	16	Lee Vining	Mono	16
Lake Tahoe	Placer	16	Lee Wash	Inyo	16
Lake Wyandotte	Butte	11	Leech Lake Mountain	Mendocino	16
Lakehead	Shasta	16	Leesville	Colusa	11
Lakeland Village	Riverside	10	Leggett	Mendocino	4

City	County	CZ	City	County	CZ
Lemon Grove	San Diego	7	Lockeford	San Joaquin	12
Lemoencove	Tulare	13	Lockhart	San Bernardino	14
Lemoore	Kings	13	Lockwood	Monterey	4
Lennox	Los Angeles	8	Loco	Inyo	16
Lenwood	San Bernardino	14	Lodgepole	Lassen	16
Leona Valley	Los Angeles	14	Lodi	San Joaquin	12
Leucadia	San Diego	7	Lodoga	Colusa	11
Lewiston	Trinity	16	Loert Otay Reservoir	San Diego	10
Lewiston Lake	Trinity	16	Logandale	Glenn	11
Liberty Farms	Solano	12	Loleta	Humboldt	1
Libfarm	Solano	12	Loma Linda	San Bernardino	10
Likely	Modoc	16	Loma Mar	San Mateo	3
Lincoln	Placer	11	Loma Prieta	Santa Clara	4
Lincoln Village	San Joaquin	12	Loma Rica	Yuba	11
Linda	Yuba	11	Lomita	Los Angeles	6
Linda Vista	San Diego	7	Lomo	Butte	16
Lindcove	Tulare	13	Lomo	Sutter	11
Linden	San Joaquin	12	Lompoc	Santa Barbara	5
Lindsay	Tulare	13	Lone Pine	Inyo	16
Litchfield	Lassen	16	Lone Tree Canyon	Kern	16
Little Dixie Wash	Kern	14	Long Barn	Tuolumne	16
Little Grass Valley Reservoir	Plumas	16	Long Beach	Los Angeles	6/8
Little Kern River	Tulare	16	Longvale	Mendocino	2
Little Lake	Inyo	16	Lonoak	Monterey	4
Little Panoche	Fresno	13	Lookout	Modoc	16
Little River	Humboldt	1	Lookout Junction	Modoc	16
Little River	Mendocino	1	Loomis	Placer	11
Little Rock Wash	Los Angeles	4	Loon Lake Reservoir	El Dorado	16
Little Shasta	Siskiyou	16	Lopez Lake	San Luis Obispo	5
Little Shasta River	Siskiyou	16	Lorraine	Kern	16
Little Truckee River	Sierra	16	Los Alamitos	Orange	8
Little Valley	Lassen	16	Los Alamos	Santa Barbara	5
Little Walker River	Mono	16	Los Altos	Santa Clara	4
Littlerock	Los Angeles	14	Los Altos Hills	Santa Clara	4
Live Oak	Santa Cruz	3	Los Angeles	Los Angeles	8/0
Live Oak	Sutter	11	Los Banos	Merced	12
Live Oak Springs	San Diego	14	Los Banos Reservoir	Merced	12
Livermore	Alameda	12	Los Berros Canyon	San Luis Obispo	5
Livingston	Merced	12	Los Gatos	Santa Clara	4
Llanada	San Benito	4	Los Molinos	Tehama	11
Llano	Los Angeles	14	Los Nietos	Los Angeles	9

City	County	CZ	City	County	CZ
Los Olivos	Santa Barbara	5	Mammoth Wash	Imperial	15
Los Osos	San Luis Obispo	5	Manchester	Mendocino	4
Los Serranos	San Bernardino	10	Manhattan Beach	Los Angeles	6
Lost Hills	Kern	13	Manix	San Bernardino	14
Lost River	Modoc	16	Manley Peak	Inyo	16
Lostman Spring	Inyo	16	Manteca	San Joaquin	12
Lotus	El Dorado	12	Manton	Tehama	16
Lower Bear River Reservoir	San Diego	16	Manzanita Lake	Shasta	16
Lower Klamath Lake	Siskiyou	16	Maple Creek	Humboldt	4
Lower Lake	Lake	2	Marble Canyon	Inyo	16
Lower Lake	Modoc	16	March A.F.B.	Riverside	10
Lowrey	Tehama	11	Mare Island Naval Facility	Solano	3
Loyalton	Sierra	16	Margarita Peak	San Diego	10
Lucas Vly-Marinwood	Sonoma	2	Maricopa	Kern	13
Lucerne	Lake	2	Marin City	Marin	3
Lucerne Lake	San Bernardino	14	Marina	Monterey	3
Lucerne Valley	San Bernardino	14	Marina del Rey	Los Angeles	9
Lucia	Monterey	3	Mariposa	Mariposa	12
Ludlow	San Bernardino	14	Markleeville	Alpine	16
Lynwood	Los Angeles	8	Markley Cove	Napa	2
Lyonville	Tehama	16	Marshall	Marin	3
Lytle Creek	San Bernardino	16	Martell	Amador	12
Lytton	Sonoma	2	Martinez	Contra Costa	12
			Martinez Canyon	Riverside	15
M			Marysville	Yuba	11
			Mason Station	Lassen	16
Macdoel	Siskiyou	16	Massack	Plumas	16
Madeline	Lassen	16	Mather	Tuolumne	16
Madeline Plains	Lassen	16	Mather Air Force Base	Sacramento	12
Madera	Madera	13	Matheson	Shasta	11
Madera Acres	Madera	13	Matterhorn Peak	Mono	16
Madera Canal	Madera	13	Matterhorn Peak	Tuolumne	16
Madison	Yolo	12	Mattole River	Humboldt	4
Magalia	Butte	11	Mattole River (North Fork)	Humboldt	4
Mail Ridge	Humboldt	2	Mattole River (South Fork)	Humboldt	4
Malaga	Fresno	13	Maxwell	Colusa	11
Malibu	Los Angeles	6	May	Siskiyou	16
Mammoth	Modoc	16	Mayacmas Mountains	Lake	2
Mammoth Lakes	Mono	16	Maywood	Los Angeles	8
Mammoth Pool Reservoir	Fresno	16	McArthur	Modoc	16
Mammoth Pool Reservoir	Madera	16	McArthur	Shasta	16

City	County	CZ	City	County	CZ
McCann	Humboldt	2	Middle Tuolumne River	Tuolumne	16
McClellan Air Force Base	Sacramento	12	Middle Yuba River	Nevada	16
McCloud	Siskiyou	16	Middle Yuba River	Yuba	16
McCloud River	Shasta	16	Middletown	Lake	2
McCoy Wash	Riverside	15	Midland	Riverside	15
McDonald Peak	Lassen	16	Midpines	Mariposa	16
McFarland	Kern	13	Midway	Alameda	12
McGee Canyon	Mono	16	Midway	San Bernardino	14
McKinleyville	Humboldt	4	Midway Well	Inyo	14
McKittrick	Kern	13	Midwell Well	Imperial	14
McMillan Canyon	San Luis Obispo	4	Milford	Lassen	16
Meadow Lakes	Fresno	16	Mill Creek	Tehama	16
Meadow Valley	Plumas	16	Mill Valley	Marin	3
Meadow Vista	Placer	11	Millbrae	San Mateo	3
Meares	Modoc	16	Miller Spring	Inyo	14
Mecca	Riverside	15	Millerton Lake	Fresno	13
Meeks Bay	El Dorado	16	Millerton Lake	Madera	13
Meiners Oaks	Ventura	9	Milligan	San Bernardino	15
Meiss Lake	Siskiyou	16	Millville	Shasta	11
Melones Reservoir	Calaveras	12	Mile	Tulare	13
Melones Reservoir	Tuolumne	12	Milpitas	Santa Clara	4
Mendocino	Mendocino	4	Milton	Calaveras	12
Mendota	Fresno	13	Mina	Mendocino	2
Menlo Park	San Mateo	3	Mineral	Tehama	16
Mentone	San Bernardino	10	Mineral King	Tulare	16
Merced	Merced	12	Minneola	San Bernardino	14
Merced Falls	Merced	12	Mira Canyon	Los Angeles	9
Merced River	Merced	12	Mira Loma	Riverside	10
Merced River (South Fork)	Mariposa	16	Miracle Hot Springs	Kern	16
Meridian	Sutter	11	Miramar	San Mateo	3
Merle Collins Reservoir	Yuba	11	Miramar Naval Air Station	San Diego	7
Mesa Grande	San Diego	14	Miramonte	Fresno	13
Mesaville	Riverside	15	Miranda	Humboldt	2
Mesquite Lake	San Bernardino	14	Mission Bay	San Diego	7
Mettler	Kern	13	Mission Viejo	Orange	8
Metz	Monterey	4	Mitchell Caverns	San Bernardino	14
Meyers	El Dorado	16	Mi-Wuk Village	Tuolumne	12
Michigan Bluff	Placer	16	Moccasin	Plumas	16
Middle Alkali Lake	Modoc	16	Moccasin	Tuolumne	12
Middle River	San Joaquin	12	Modesto	Stanislaus	12
Middle River Town	San Joaquin	12	Modesto Reservoir	Stanislaus	12

City	County	CZ	City	County	CZ
Modjeska	Orange	8	Morgan Hill	Santa Clara	4
Moffett Field Naval Air Station	Santa Clara	4	Mormon Bar	Mariposa	12
Mojave	Kern	14	Mormon Slough	San Joaquin	12
Mojave River	San Bernardino	14	Morongo Valley	San Bernardino	14
Mojave River Forks Reservoir	San Bernardino	14	Morrison Slough	Sutter	11
Mokelumne Hill	Calaveras	12	Morro Bay	San Luis Obispo	5
Mokelumne River	San Joaquin	12	Moss Beach	San Mateo	3
Monmouth	Fresno	13	Moss Landing	Monterey	3
Mono Hot Springs	Fresno	16	Mount Baldy	San Bernardino	16
Mono Lake	Mono	16	Mount Bullion	Mariposa	12
Monolith	Kern	16	Mount Carmel	Monterey	4
Monrovia	Los Angeles	9	Mount Center	Riverside	16
Monson	Tulare	13	Mount Darwin	Fresno	16
Monta Vista	Santa Clara	4	Mount Darwin	Inyo	16
Montague	Siskiyou	16	Mount Diablo	Contra Costa	12
Montalvo	Ventura	6	Mount Eddy	Siskiyou	16
Montara	San Mateo	3	Mount Eddy	Trinity	16
Montclair	San Bernardino	10	Mount Eden	Alameda	3
Monte Nido	Los Angeles	6	Mount Hamilton	Santa Clara	4
Monte Rio	Sonoma	2	Mount Hebron	Siskiyou	16
Monte Sereno	Santa Clara	4	Mount Hermon	Santa Clara	3
Montebello	Los Angeles	9	Mount Hoffman	Siskiyou	16
Montecito	Santa Barbara	6	Mount Konocti	Lake	2
Monterey	Monterey	3	Mount Laguna	San Diego	14
Monterey Bay	Monterey	3	Mount Lassic	Humboldt	2
Monterey Bay	Santa Cruz	3	Mount Lyell	Madera	16
Monterey Park	Los Angeles	9	Mount Lyell	Mono	16
Montezuma	Solano	12	Mount Morgan	Inyo	16
Montezuma Slough	Solano	12	Mount Patterson	Mono	16
Montgomery Creek	Shasta	16	Mount Pinchot	Fresno	16
Monticello Dam	Solano	2	Mount Pinos	Ventura	16
Montpelier	Stanislaus	12	Mount Saint Helena	Napa	2
Montrose	Los Angeles	9	Mount Saint Helena	Sonoma	2
Monument Peak	San Diego	14	Mount San Antonio	Los Angeles	16
Moon Lake	Lassen	16	Mount San Antonio	San Bernardino	16
Moorpark	Ventura	9	Mount San Jacinto	Riverside	16
Morada	San Joaquin	12	Mount Shasta	Siskiyou	16
Moraga	Contra Costa	12	Mount Signal	Imperial	15
Morales Canyon	San Luis Obispo	4	Mount Vida	Modoc	16
Morena Village	San Diego	14	Mount Whitney	Inyo	16
Moreno Valley	Riverside	10	Mount Whitney	Tulare	16

City	County	CZ	City	County	CZ
Mount Wilson	Los Angeles	16	Newell	Modoc	16
Mountain Gate	Shasta	11	Newhall	Los Angeles	9
Mountain Meadows Reservoir	Lassen	16	Newman	Stanislaus	12
Mountain Pass	San Bernardino	14	Newport Bay	Orange	6
Mountain Ranch	Calaveras	12	Newport Beach	Orange	6
Mountain Spring	Imperial	15	Newville	Glenn	11
Mountain View	Santa Clara	4	Nicasio	Marin	2
Mugginsville	Siskiyou	16	Nice	Lake	2
Murphys	Calaveras	12	Nicholls Warm Springs	Riverside	15
Murrieta	Riverside	10	Nicolaus	Sutter	11
Muscoy	San Bernardino	10	Nightingale	Riverside	16
Myers Flat	Humboldt	2	Niland	Imperial	15
			Nimbus	Sacramento	12
N			Nipomo	San Luis Obispo	5
			Nipton	San Bernardino	14
Nacimiento Reservoir	San Luis Obispo	4	Nopah Range	Inyo	14
Nacimiento River	San Luis Obispo	4	Norse	Riverside	10
Napa	Napa	2	Nord	Butte	11
Napa Junction	Napa	2	Norden	Nevada	16
Naples	Santa Barbara	6	North Auburn	Placer	11
Nashmead	Mendocino	2	North Bloomfield	Nevada	16
National City	San Diego	7	North Columbia	Nevada	11
Navarro	Mendocino	2	North Edwards	Kern	14
Navelencia	Fresno	13	North Fork	Madera	16
Needles	San Bernardino	15	North Highlands	Sacramento	12
Nelson	Butte	11	North Hollywood	Los Angeles	9
Neuralia	Kern	14	North Palm Springs	Riverside	15
Nevada City	Nevada	11	North Sacramento	Sacramento	12
New Almaden	Santa Clara	4	North San Juan	Nevada	11
New Auberry	Fresno	13	North Yolla Bolly Mountains	Tehama	16
New Bullards Bar Reservoir	Yuba	16	North Yuba River	Yuba	16
New Cuyama	Santa Barbara	4	Northridge	Los Angeles	9
New Don Pedro Reservoir	Tuolumne	12	Northspur	Mendocino	2
New Exchequer Dam	Mariposa	12	Norton AFB	San Bernardino	10
New Hogan Reservoir	Calaveras	12	Norvell	Lassen	16
New London	Tulare	13	Norwalk	Los Angeles	8
New River	Trinity	16	Notleys Landing	Monterey	3
Newark	Alameda	3	Novato	Marin	2
Newberry Springs	San Bernardino	14	Nubieber	Lassen	16
Newbury Park	Ventura	9	Nuevo	Riverside	10
Newcastle	Placer	11			

City	County	CZ	City	County	CZ
O			One	Shasta	41
			Ontario	San-Bernardino	40
Oak Grove	San-Diego	44	Onyx	Kern	46
Oak Ridge	Ventura	9	Opal Cliffs	Santa-Cruz	3
Oak Run	Shasta	41	Orange	Orange	8
Oak View	Ventura	9	Orange Cove	Fresno	43
Oakdale	Stanislaus	42	Orangevale	Sacramento	42
Oakhurst	Madera	43	Orchard Peak	Kern	43
Oakland-AP	Alameda	3	Orcutt	Santa-Barbara	5
Oakley	Contra-Costa	42	Ord Mountain	San-Bernardino	14
Oakville	Napa	2	Ordbend	Glenn	41
Oasis	Mono	16	Oregon House	Yuba	41
Oasis	Riverside	45	Oregon Peak	Yuba	46
Obie	Shasta	46	Orestimba Peak	Stanislaus	42
O'Brien	Shasta	46	Orick	Humboldt	4
Observation Peak	Lassen	46	Orinda	Contra-Costa	42
Occidental	Sonoma	2	Orita	Imperial	45
Ocean Beach	San-Diego	7	Orland	Glenn	41
Ocean View	Sonoma	4	Orleans	Humboldt	2
Oceano	San-Luis-Obispo	5	Oro-Fine	Siskiyou	46
Oceanside	San-Diego	7	Oro-Grande	San-Bernardino	44
Ocotillo	Imperial	45	Oro-Grande Wash	San-Bernardino	44
Ocotillo Wells	San-Diego	45	Oro-Loma	Fresno	43
Ogilby	Imperial	45	Orosi	Tulare	43
Oildale	Kern	43	Oroville	Butte	41
Oilfields	Fresno	43	Oroville-East	Butte	41
Ojai	Ventura	9	Otay	San-Diego	7
Olancho	Inyo	46	Outingdale	El-Dorado	42
Olancho Peak	Inyo	46	Owens Lake	Inyo	46
Olancho Peak	Tulare	46	Owens River	Inyo	46
Old Dale	San-Bernardino	44	Owens Valley	Inyo	46
Old River	Contra-Costa	42	Owenye	Inyo	46
Old River	Kern	43	Owlhead Mountains	Inyo	44
Old River	San-Joaquin	42	Owlhead Mountains	San-Bernardino	44
Old Station	Shasta	46	Oxalis	Fresno	43
Olema	Marin	3	Oxford	Solano	42
Olinda	Shasta	41	Oxnard	Ventura	6
Olivehurst	Yuba	41	Oxnard Beach	Ventura	6
Omo Ranch	El-Dorado	46			
O'Neale	Madera	43	P		
O'Neill Forebay	Merced	42			

City	County	CZ	City	County	CZ
Pacheco	Contra-Costa	12	Pardee Reservoir	Calaveras	12
Pacheco Pass	Santa Clara	4	Parker Dam	San Bernardino	15
Pacific	El Dorado	16	Parkfield	Monterey	4
Pacific Beach	San Diego	7	Parkway South Sacramento	Sacramento	12
Pacific Grove	Monterey	3	Parlier	Fresno	13
Pacific Palisades	Los Angeles	6	Pasadena	Los Angeles	9
Pacificia	San Mateo	3	Paskenta	Tehama	11
Pacoima	Los Angeles	16	Paso Robles AP	San Luis Obispo	4
Pacoima Canyon	Los Angeles	16	Patrick Creek	Del Norte	16
Pahrump Valley	Inyo	14	Patricks Point	Humboldt	1
Paicines	San Benito	4	Patterson	Stanislaus	12
Paiute Canyon	Inyo	16	Paulsell	Stanislaus	12
Pala	San Diego	40	Pauma Valley	San Diego	40
Palen Lake	Riverside	15	Paxton	Plumas	16
Palen Mountains	Riverside	15	Paynes Creek	Tehama	11
Palermo	Butte	11	Peanut	Trinity	16
Palm Canyon	Riverside	15	Pearblossom	Los Angeles	14
Palm City	San Diego	7	Pearland	Los Angeles	14
Palm Desert	Riverside	15	Pebble Beach	Monterey	3
Palm Desert Country	Riverside	15	Pedley	Riverside	10
Palm Springs	Riverside	15	Pendleton M.C.B.	San Diego	7
Palm Wash	Imperial	15	Penn Valley	Nevada	11
Palm Wells	San Bernardino	14	Penngrove	Sonoma	2
Palmdale AP	Los Angeles	14	Pennington	Sutter	11
Palo Alto	Santa Clara	4	Penryn	Placer	11
Palo Cedro	Shasta	11	Pentz	Butte	11
Palo Verde	Imperial	15	Pepperwood	Humboldt	1
Palo Verde Valley	Riverside	15	Perez	Modoc	16
Paloma	Calaveras	12	Perris	Riverside	10
Palomar Mountain	San Diego	14	Pescadero	San Mateo	3
Palos Verdes Estates	Los Angeles	6	Petaluma	Sonoma	2
Panamint	Inyo	16	Petaluma River	Marin	2
Panamint Range	Inyo	16	Petaluma River	Sonoma	2
Panamint Springs	Inyo	14	Peters	San Joaquin	12
Panamint Valley	Inyo	14	Petrolia	Humboldt	1
Panoche	San Benito	4	Phelan	San Bernardino	14
Panorama City	Los Angeles	9	Phillipsville	Humboldt	2
Paradise	Butte	11	Philo	Mendocino	2
Paraiso Springs	Monterey	4	Picacho	Imperial	15
Paramount	Los Angeles	8	Picacho Wash	Imperial	15
Pardee Reservoir	Amador	12	Pico Rivera	Los Angeles	9

City	County	CZ	City	County	CZ
Piedmont	Alameda	3	Pittsburg	Contra Costa	12
Piedra PO	Fresno	13	Pittville	Shasta	16
Pierce	Siskiyou	16	Piute Valley	San Bernardino	14
Piercy	Mendocino	2	Piute Wash	San Bernardino	14
Pieta	Mendocino	2	Pixley	Tulare	13
Pigeon Point	San Mateo	3	Placentia	Orange	8
Pillar Point	San Mateo	3	Placerville	El Dorado	12
Pilot Hill	El Dorado	12	Plainsburg	Merced	12
Pilot Peak	Mariposa	16	Plainview	Tulare	13
Pilot Peak	Nevada	11	Planada	Merced	12
Pilot Peak	Plumas	16	Plantation	Sonoma	4
Pilot Peak	Tuolumne	16	Plasse	Amador	16
Pine Canyon	Fresno	13	Plaster City	Imperial	15
Pine Canyon	Monterey	4	Platina	Shasta	11
Pine Canyon	San Luis Obispo	4	Pleasant Grove	Inyo	16
Pine Canyon	Santa Barbara	5	Pleasant Hill	Contra Costa	12
Pine Flat	Tulare	16	Pleasant Hill	Sutter	11
Pine Grove	Amador	12	Pleasanton	Alameda	12
Pine Mountain	San Luis Obispo	4	Plumas	Lassen	16
Pine Mountain	Ventura	16	Plymouth	Amador	12
Pine Ridge	Fresno	16	Point Arena	Mendocino	4
Pine Valley	San Diego	14	Point Arguello	Santa Barbara	5
Pinecrest	Tuolumne	16	Point Bonita	Marin	3
Pinedale	Fresno	13	Point Buchon	San Luis Obispo	5
Pinehurst	Fresno	16	Point Conception	Santa Barbara	6
Pinkham Wash	Riverside	15	Point Delgada	Humboldt	4
Pinnacles NM	San Benito	4	Point Dume	Los Angeles	6
Pinole	Contra Costa	3	Point Fermin	Los Angeles	6
Pinon Hills	San Bernardino	14	Point La Jolla	San Diego	7
Pinto Mountains	Riverside	14	Point Lobos	Monterey	3
Pinto Wash	Imperial	15	Point Loma	San Diego	7
Pinto Wash	Riverside	14	Point Mugu	Ventura	6
Pioneer	Amador	16	Point Mugu Naval Missile Center	Ventura	6
Pioneer Point	San Bernardino	14	Point Piedras Blancas	San Luis Obispo	5
Pioneertown	San Bernardino	14	Point Pleasant	Sacramento	12
Pipes Wash	San Bernardino	14	Point Reyes	Marin	3
Piru	Ventura	9	Point Reyes Station	Marin	3
Pismo Beach	San Luis Obispo	5	Point Saint George	Del Norte	4
Pit River (North Fork)	Modoc	16	Point Sal	Santa Barbara	5
Pit River (South Fork)	Modoc	16	Point Sur	Monterey	3
Pit River (town)	Lassen	16	Pollock Pines	El Dorado	16

City	County	CZ	City	County	CZ
Pomona	Los Angeles	9	Quedow Mountain	Tulare	13
Pond	Kern	13	Quincy	Plumas	16
Pondosa	Siskiyou	16			
Pope Valley	Napa	2	R		
Poplar	Tulare	13			
Porcupine Wash	Riverside	14	Racherby	Yuba	14
Port Chicago	Contra Costa	12	Rag Gulch	Kern	13
Port Hueneme	Ventura	6	Rail Road Flat	Calaveras	12
Porterville	Tulare	13	Railroad Canyon Reservoir	Riverside	10
Portola	Plumas	16	Rainbow	San Diego	10
Portola Valley	San Mateo	3	Raisin City	Fresno	13
Posey	Tulare	13	Raker & Thomas Reservoir	Modoc	16
Posts	Monterey	3	Ramona	San Diego	10
Potrero	San Diego	14	Ranch	Mendocino	4
Potter Valley	Mendocino	2	Ranchita	San Diego	14
Poway Valley	San Diego	10	Rancho Bernardo	San Diego	10
Powell Canyon	Monterey	4	Rancho Cordova	Sacramento	12
Poze	San Luis Obispo	4	Rancho Cucamonga	San Bernardino	10
Prado Flood Control Basin	Riverside	10	Rancho Mirage	Riverside	15
Prado Flood Control Basin	San Bernardino	10	Rancho Palms Verdes	Los Angeles	6
Prather	Fresno	13	Rancho San Diego	San Diego	10
Presidio of San Francisco	San Francisco	3	Rancho Santa Fe	San Diego	7
Preston Peak	Siskiyou	16	Rancho Santa Margarita	Orange	8
Priest Valley	Monterey	4	Randsburg	Kern	14
Princeton	Colusa	11	Ravendale	Lassen	16
Proberta	Tehama	11	Raymond	Madera	13
Project City	Shasta	11	Red Bank	Tehama	11
Providence Mountains	San Bernardino	14	Red Bluff	Tehama	11
Prunedale	Monterey	3	Red Mountain	Del Norte	16
Pulga	Butte	16	Red Mountain	San Bernardino	14
Purdy	Sierra	16	Red Top	Madera	13
Purisma Hills	Santa Barbara	5	Red Wall Canyon	Inyo	16
Putah South Canal	Solano	12	Redcrest	Humboldt	4
Pyramid Lake	Los Angeles	16	Redding	Shasta	11
Q			Redlands	San Bernardino	10
			Redman	Los Angeles	14
			Redondo Beach	Los Angeles	6
Quail Valley	Riverside	10	Redway	Humboldt	2
Quartz Hill	Los Angeles	14	Redwood City	San Mateo	3
Quartz Peak	Imperial	15	Redwood Estates	Santa Clara	4
Quatal Canyon	Ventura	16	Redwood Valley	Mendocino	2

City	County	CZ	City	County	CZ
Reedley	Fresno	13	Rodeo	Contra Costa	3
Reliz Canyon	Monterey	4	Rogers Lake	Kern	14
Renegade Canyon	Inyo	16	Rohnert Park	Sonoma	2
Requa	Del Norte	1	Rohnerville	Humboldt	1
Rescue	El Dorado	12	Rolinda	Fresno	13
Reseda	Los Angeles	9	Rolling Hills	Los Angeles	6
Reynolds	Mendocino	2	Rolling Hills Estates	Los Angeles	6
Rhodes Wash	Inyo	14	Romoland	Riverside	10
Rialto	San Bernardino	10	Rosamond	Kern	14
Rice	San Bernardino	15	Rosamond Lake	Kern	14
Rice Valley	Riverside	15	Rosamond Lake	Los Angeles	14
Richardson Grove	Humboldt	2	Roseland	Sonoma	2
Richardson Springs	Butte	11	Rosemead	Los Angeles	9
Richfield	Tehama	11	Rosemont	Sacramento	12
Richgrove	Tulare	13	Roseville	Placer	11
Richmond	Contra Costa	3	Rosewood	Tehama	11
Richvale	Butte	11	Ross	Marin	2
Ridge	Mendocino	2	Rossmoor	Orange	8
Ridgecrest	Kern	14	Rough and Ready	Nevada	11
Riggs Wash	San Bernardino	14	Round Mountain	Shasta	16
Rio Del Mar	Santa Cruz	3	Rovana	Inyo	16
Rio Dell	Humboldt	1	Rowland Heights	Los Angeles	9
Rio Linda	Sacramento	12	Rubicon River	El Dorado	16
Rio Nido	Sonoma	2	Rubicon River	Placer	16
Rio Oso	Sutter	11	Rubidoux	Riverside	10
Rio Vista	Solano	12	Rumsey	Yolo	12
Ripley	Riverside	15	Running Springs	San Bernardino	16
Ripon	San Joaquin	12	Russian Peak	Siskiyou	16
Ripperdan	Madera	13	Ruth	Trinity	16
River Pines	Amador	12	Rutherford	Napa	2
River Springs Lakes	Mono	16	Ryan	Inyo	14
Riverbank	Stanislaus	12	Ryde	Sacramento	12
Riverbank Army Depot	Stanislaus	12			
Riverdale	Fresno	13	S		
Riverside	Riverside	10			
Roaring River	Fresno	16	Sacramento AP	Sacramento	12
Robbins	Sutter	11	Sacramento Army Depot	Sacramento	12
Robla	Sacramento	12	Saddle Mountain	El Dorado	16
Rocklin	Placer	11	Sage	Riverside	10
Rockport	Mendocino	1	Sage Hen	Lassen	16
Rockville	Solano	12	Saint Bernard	Tehama	16

City	County	CZ	City	County	CZ
Saint Helena	Napa	2	San Buenaventura	Ventura	6
Saint Johns River	Tulare	13	San Carlos	San Mateo	3
Saint Mary's College	Contra Costa	12	San Clemente	Orange	6
Salida	Stanislaus	12	San Clemente Island	Los Angeles	6
Salinas	Monterey	3	San Diego	San Diego	7/10
Saline Valley	Inyo	16	San Diego Bay	San Diego	7
Salmon Mountain	Humboldt	16	San Diego Naval Hospital	San Diego	7
Salmon Mountain	Siskiyou	16	San Diego Naval Station	San Diego	7
Salmon River	Siskiyou	16	San Dimas	Los Angeles	9
Salmon River (East Fork)	Siskiyou	16	San Felipe	San Diego	14
Salmon River (North Fork)	Siskiyou	16	San Felipe	Santa Clara	4
Salmon River (South Fork)	Siskiyou	16	San Fernando	Los Angeles	9
Salt Lake	Inyo	16	San Fernando Valley	Los Angeles	9
Salt River	Humboldt	1	San Francisco	San Francisco	3
Salt Springs Reservoir	Amador	16	San Francisco Bay	San Francisco	3
Salt Springs Reservoir	Calaveras	16	San Gabriel	Los Angeles	9
Salt Springs Valley Reservoir	Calaveras	12	San Gabriel Mountains	Los Angeles	16
Saltdale	Kern	14	San Gabriel River (West Fork)	Los Angeles	16
Saltmarsh	San Bernardino	15	San Geronio Mountain	San Bernardino	16
Salton City	Imperial	15	San Geronio Pass	Riverside	15
Salton Sea	Imperial	15	San Geronio River	Riverside	15
Salton Sea	Riverside	15	San Gregorio	San Mateo	3
Saltus	San Bernardino	15	San Jacinto	Riverside	10
Salyer	Trinity	16	San Jacinto Mountains	Riverside	15
Samea	Humboldt	1	San Jacinto River	Riverside	10
San Andreas	Calaveras	12	San Joaquin	Fresno	13
San Andreas Lake	San Mateo	3	San Joaquin River (East Fork)	Madera	16
San Anselmo	Marin	2	San Joaquin River (Middle Fork)	Madera	16
San Antonio Canyon	Los Angeles	16	San Joaquin River (North Fork)	Madera	16
San Antonio Mission	Monterey	4	San Joaquin River (South Fork)	Madera	16
San Antonio Reservoir	Alameda	12	San Joaquin River (West Fork)	Madera	16
San Antonio Reservoir	Monterey	4	San Jose	Santa Clara	4
San Antonio River	Monterey	4	San Juan Bautista	San Benito	4
San Antonio River (North Fork)	Monterey	4	San Juan Capistrano	Orange	6
San Arde	Monterey	4	San Leandro	Alameda	3
San Benito	San Benito	4	San Lorenzo	Alameda	3
San Benito Mountain	San Benito	4	San Lorenzo River	Santa Cruz	3
San Benito River	San Benito	4	San Lucas	Monterey	4
San Bernardino	San Bernardino	10	San Luis Holding Reservoir	Merced	12
San Bernardino Mountains	San Bernardino	16	San Luis Obispo	San Luis Obispo	5
San Bruno	San Mateo	3	San Luis Obispo Bay	San Luis Obispo	5

City	County	CZ	City	County	CZ
San Luis Rey	San Diego	7	Santa Cruz	Santa Cruz	3
San Luis Rey River (West Fork)	San Diego	14	Santa Cruz Island	Santa Barbara	6
San Marcos	San Diego	10	Santa Cruz Mountains	Santa Cruz	3
San Marine	Los Angeles	9	Santa Fe Springs	Los Angeles	9
San Martin	Santa Clara	4	Santa Margarita	San Luis Obispo	4
San Mateo	San Mateo	3	Santa Margarita Lake	San Luis Obispo	4
San Mateo Canyon	San Diego	10	Santa Maria	Santa Barbara	5
San Miguel	San Luis Obispo	4	Santa Maria River	San Luis Obispo	5
San Miguel Island	Santa Barbara	6	Santa Maria River	Santa Barbara	5
San Nicholas Island	Ventura	6	Santa Maria Valley	Santa Barbara	5
San Onofre	San Diego	7	Santa Monica	Los Angeles	6
San Onofre Canyon	San Diego	10	Santa Monica Bay	Los Angeles	6
San Pablo	Contra Costa	3	Santa Monica Mountains	Los Angeles	6
San Pasqual	San Diego	10	Santa Paula	Ventura	9
San Pedro	Los Angeles	6	Santa Rita Park	Merced	12
San Pedro Bay	Los Angeles	6	Santa Rosa	Sonoma	2
San Quentin	Marin	2	Santa Rosa Islands	Santa Barbara	6
San Rafael	Marin	2	Santa Rosa Mountains	Riverside	15
San Rafael Mountain	Santa Barbara	5	Santa Susana	Ventura	9
San Ramon	Contra Costa	12	Santa Venetia	Marin	2
San Simeon	San Luis Obispo	5	Santa Ynez	Santa Barbara	5
San Timoteo Canyon	Riverside	10	Santa Ynez Mountains	Santa Barbara	5
San Vicente Reservoir	San Diego	10	Santa Ynez River	Santa Barbara	5
San Ysidro	San Diego	7	Santa Ysabel	San Diego	14
San Ysidro Mountains	San Diego	10	Santee	San Diego	10
Sand City	Monterey	3	Santiago Reservoir	Orange	8
Sand Hills	Imperial	15	Saratoga	Santa Clara	4
Sandberg	Los Angeles	16	Sardine Peak	Sierra	16
Sandia	Imperial	15	Sargent	Santa Clara	4
Sands	San Bernardino	14	Sargent Canyon	Monterey	4
Sanel Mountain	Mendocino	2	Saticoy	Ventura	6
Sanger	Fresno	13	Sattley	Sierra	16
Sanitarium	Napa	2	Saugus	Los Angeles	6
Santa Ana	Orange	8	Sausalite	Marin	3
Santa Barbara	Santa Barbara	6	Sawtooth Peak	Inyo	16
Santa Barbara Island	Santa Barbara	6	Sawyers Bar	Siskiyou	16
Santa Catalina Island	Los Angeles	6	Scarface	Modoc	16
Santa Clara	Santa Clara	4	Schoolite	Inyo	16
Santa Clara River	Ventura	6/9	Schellville	Sonoma	2
Santa Clara Valley	Santa Clara	4	Scotia	Humboldt	1
Santa Clarita	Los Angeles	9	Scott Bar	Siskiyou	16

City	County	CZ	City	County	CZ
Scott Bar Mountains	Siskiyou	16	Sherman Oaks	Los Angeles	9
Scott Mountains	Trinity	16	Sherman Peak	Tulare	16
Scott River	Siskiyou	16	Shingle Springs	El Dorado	12
Scott River (East Fork)	Siskiyou	16	Shingletown	Shasta	16
Scotts	Lassen	16	Shively	Humboldt	4
Scotts Valley	Santa Cruz	3	Shoshone	Inyo	14
Scottys Castle	Inyo	16	Sidewinder Mountain	San Bernardino	14
Sea Cliff	Ventura	6	Sierra Army Depot	Lassen	16
Seal Beach	Orange	6	Sierra Buttes	Sierra	16
Searles	Kern	14	Sierra City	Sierra	16
Searles Lake	San Bernardino	14	Sierra Madre	Los Angeles	9
Seaside	Monterey	3	Sierra Nevada	Madera	16
Sebastopol	Sonoma	2	Sierra Valley	Plumas	16
Seeley	Imperial	15	Sierra Valley	Sierra	16
Seiad Valley	Siskiyou	16	Sierraville	Sierra	16
Selma	Fresno	13	Signal Hill	Los Angeles	6
Senator Wash	Imperial	15	Silver City	Tulare	16
Seneca	Plumas	16	Silver Creek	Fresno	13
Sepulveda	Los Angeles	9	Silver Lake	Amador	16
Sepulveda Dam	Los Angeles	9	Silver Lake	San Bernardino	14
Sequoia	Humboldt	2	Silverado	Orange	8
Sespe	Ventura	9	Silverwood Lake	San Bernardino	16
Seven Oaks	San Bernardino	16	Simi Valley	Ventura	9
Shadow Valley	San Bernardino	14	Simmler	San Luis Obispo	4
Shafter	Kern	13	Siskiyou Mountains	Del Norte	16
Shandon	San Luis Obispo	4	Siskiyou Mountains	Siskiyou	16
Sharpe Army Depot	San Joaquin	12	Sisquoc	Santa Barbara	5
Shasta	Shasta	11	Sisquoc River	Santa Barbara	5
Shasta Bally	Shasta	11	Sites	Colusa	11
Shasta Lake	Shasta	16	Skaggs Springs	Sonoma	2
Shasta River	Siskiyou	16	Skedaddle Mountains	Lassen	16
Shasta Springs	Siskiyou	16	Skidoo	Inyo	16
Shasta Valley	Siskiyou	16	Slate Range	Inyo	14
Shaver Lake	Fresno	16	Slate Range	San Bernardino	14
Shedd Canyon	San Luis Obispo	4	Sleepy Valley	Los Angeles	9
Sheep Canyon	Inyo	14	Sloat	Plumas	16
Sheep Mountain	Siskiyou	16	Sloughhouse	Sacramento	12
Sheep Ranch	Calaveras	12	Smartville	Yuba	11
Sheldon	Sacramento	12	Smith River	Del Norte	4
Shelter Cove	Humboldt	4	Smith River (Middle Fork)	Del Norte	16
Sheridan	Placer	11	Smith River (North Fork)	Del Norte	16

City	County	CZ	City	County	CZ
Smith River (South Fork)	Del Norte	16	South Yuba City	Sutter	11
Smithflat	El Dorado	12	Spangler	San Bernardino	14
Smoke Tree Wash	Riverside	14	Spanish Mountain	Fresno	16
Snake River	Sutter	11	Spanish Spring	Inyo	16
Snelling	Merced	12	Spence	Monterey	3
Snowden	Siskiyou	16	Spreckels	Monterey	3
Soda Lake	San Bernardino	14	Spring Garden	Plumas	16
Soda Lake	San Luis Obispo	4	Spring Valley	San Diego	10
Soda Mountains	San Bernardino	14	Springville	Tulare	13
Soda Springs	Nevada	16	Spyrock	Mendocino	2
Soda Springs	Sonoma	4	Squaw Valley	Fresno	13
Solana Beach	San Diego	7	Squaw Valley (Olympic Valley)	Placer	16
Soledad	Monterey	3	Squirrel Inn	San Bernardino	14
Solemint	Los Angeles	9	Stacy	Lassen	16
Solromar	Ventura	6	Stampede Reservoir	Sierra	16
Solvang	Santa Barbara	5	Standard	Tuolumne	12
Somerset	El Dorado	12	Standish	Lassen	16
Somes Bar	Siskiyou	16	Stanford	Santa Clara	4
Somis	Ventura	6	Stanislaus	Calaveras	16
Sonoma	Sonoma	2	Stanislaus River (Middle Fork)	Tuolumne	16
Sonoma Mountain	Sonoma	2	Stanton	Orange	8
Sonora	Tuolumne	12	Stent	Tuolumne	12
Sonora Pass	Mono	16	Stevens	Kern	13
Sonora Pass	Tuolumne	16	Stevinson	Merced	12
Sequel	Santa Cruz	3	Stewarts Point	Sonoma	1
Soulsbyville	Tuolumne	12	Stinson Beach	Marin	3
Sourdough Spring	Inyo	16	Stirling City	Butte	16
South Dos Palos	Merced	12	Stockton	San Joaquin	12
South El Monte	Los Angeles	9	Stony Gorge Reservoir	Glenn	11
South Entry Yosemite	Tuolumne	16	Stonyford	Colusa	11
South Fork	Humboldt	1	Storrie	Plumas	16
South Gate	Los Angeles	8	Stovepipe Wells	Inyo	14
South Laguna	Orange	6	Stratford	Kings	13
South Lake Tahoe	El Dorado	16	Strathmore	Tulare	13
South Oroville	Butte	11	Strawberry	Tuolumne	16
South Pasadena	Los Angeles	9	Strawberry Valley	Yuba	16
South San Francisco	San Mateo	3	Studio City	Los Angeles	9
South San Gabriel	Los Angeles	9	Suisun Bay	Contra Costa	12
South Turlock	Stanislaus	12	Suisun Bay	Solano	12
South Whittier	Los Angeles	9	Suisun City	Solano	12
South Yolla Bolly Mountains	Tehama	16	Sulphur Springs	Ventura	9

City	County	CZ	City	County	CZ
Sultana	Tulare	13	Tambo	Yuba	11
Summerland	Santa-Barbara	6	Tarzana	Los-Angeles	6
Summit City	Shasta	11	Tassajara	Contra-Costa	2
Sun-City	Riverside	10	Tassajara Hot Springs	Monterey	4
Sun Valley	Los Angeles	9	Tatu	Mendocino	2
Suncrest	San-Diego	10	Taylor Canyon	San-Luis-Obispo	4
Sunland	Los Angeles	9	Taylor Peak	Humboldt	1
Sunnymead	Riverside	10	Taylorville	Plumas	16
Sunnyvale	Santa-Clara	4	Teagle Wash	San-Bernardino	14
Sunnyvale Air Force Station	Santa-Clara	4	Teakettle Junction	Inyo	16
Sunol	Alameda	12	Tecate	San-Diego	14
Sunset Beach	Orange	6	Tecner	Siskiyou	16
Superior Lake	San-Bernardino	14	Tecopa	Inyo	14
Superstition Mountain	Imperial	15	Tehachapi	Kern	16
Surf	Santa-Barbara	5	Tehachapi Mountains	Kern	16
Surfside	Orange	6	Tehachapi Pass	Kern	16
Surprise Valley	Modoc	16	Tehama	Tehama	11
Susan River	Lassen	16	Tejon Pass	Los Angeles	16
Susanville	Lassen	16	Tejon Rancho	Los Angeles	16
Sutter	Sutter	11	Telescope Peak	Inyo	16
Sutter Buttes	Sutter	11	Temecula	Riverside	10
Sutter Bypass	Sutter	11	Temescal Wash	Riverside	10
Sutter Creek	Amador	12	Temple City	Los Angeles	9
Svedal	Santa-Clara	4	Templeton	San-Luis-Obispo	4
Swanton	Santa-Cruz	3	Tennant	Siskiyou	16
Sweetwater Reservoir	San-Diego	10	Tequesquet Canyon	Santa-Barbara	5
Sycamore	Colusa	11	Tequesquet Peak	Santa-Barbara	5
Sylmar	Los Angeles	9	Terminus	San-Joaquin	12
T			Terminus Dam	Tulare	13
			Terme	Lassen	16
			Terra Bella	Tulare	13
Taft	Kern	13	Thermal	Riverside	15
Taft Heights	Kern	13	Thermalito	Butte	11
Tagus	Tulare	13	Thermalito Afterbay	Butte	11
Tahoe City	Placer	16	Thermalito Forebay	Butte	11
Tahoe Pines	Placer	16	Thomas A. Edison Lake	Fresno	16
Tahoe Vista	Placer	16	Thomas Mountain	Riverside	16
Tahoma	Placer	16	Thompson Canyon	Monterey	4
Tajiguas	Santa-Barbara	6	Thornton	San-Joaquin	12
Talmage	Mendocino	2	Thousand Oaks	Ventura	9
Tamalpais-Homestead Valley	Marin	3	Thousand Palms	Riverside	15

City	County	CZ	City	County	CZ
Three Points	Los Angeles	14	Trinity Mountains	Shasta	16
Three Rivers	Tulare	13	Trinity Mountains	Trinity	16
Three Rocks	Fresno	13	Trinity River (East Fork)	Trinity	16
Tiburon	Marin	3	Trona	San Bernardino	14
Tiefort Mountains	San Bernardino	14	Trowbridge	Sutter	11
Tierra del Sol	San Diego	14	Troy	Placer	16
Tiger Creek Power House	Amador	12	Truckee	Nevada	16
Tiger Creek Power House	Butte	11	Truckee River	Nevada	16
Tijuana River	San Diego	7	Tucker Canyon	San Luis Obispo	4
Tinemaha Reservoir	Inyo	16	Tudor	Sutter	11
Tioga Pass	Mono	16	Tujunga	Los Angeles	9
Tioga Pass	Tuolumne	16	Tulare	Tulare	13
Tionesta	Modoc	16	Tulare Lake Bed	Kings	13
Tipton	Tulare	13	Tule Canal	Yolo	12
Titus Canyon	Inyo	16	Tule Lake Sump	Siskiyou	16
Tobias Peak	Tulare	16	Tule Mountain	Lassen	16
Tollhouse	Fresno	13	Tule River	Kings	13
Tomales	Marin	3	Tule Wash	Imperial	15
Tomales Bay	Marin	3	Tulelake	Siskiyou	16
Toms Place	Mono	16	Tuolumne	Tuolumne	12
Topanga	Los Angeles	6	Tuolumne Meadows	Tuolumne	16
Topanga Beach	Los Angeles	6	Tuolumne River (North Fork)	Tuolumne	16
Topanga Canyon	Los Angeles	6	Tuolumne River (South Fork)	Tuolumne	16
Topaz	Mono	16	Tupman	Kern	13
Topaz Lake	Mono	16	Turk	Fresno	13
Torrance	Los Angeles	6	Turlock	Stanislaus	12
Trabuco Canyon	Orange	8	Turlock Lake	Stanislaus	12
Tracy-Carbona	San Joaquin	12	Turner	San Joaquin	12
Tranquillity	Fresno	13	Turntable Creek	Plumas	16
Traver	Tulare	13	Turntable Creek	Shasta	11
Travis A. F.B.	Solano	12	Turtle Mountains	San Bernardino	14
Treasure Island Naval Station	San Francisco	3	Tustin	Orange	8
Tremont	Solano	12	Tustin Foothills	Orange	8
Tres Pines	San Benito	4	Tuttle	Merced	12
Trigo	Madera	13	Tuttletown	Tuolumne	12
Trimmer	Fresno	16	Twain	Plumas	16
Trinidad	Humboldt	1	Twain Harte	Tuolumne	12
Trinidad Head	Humboldt	1	Twentynine Palms	San Bernardino	14
Trinity Alps	Trinity	16	Twin Bridges	El Dorado	16
Trinity Center	Trinity	16	Twin Cities	Sacramento	12
Trinity Dam	Trinity	16	Twin Lakes	Mono	16

City	County	CZ	City	County	CZ
Twin Lakes	Santa Cruz	3	Vacaville	Solano	12
Twitchell Reservoir	Santa Barbara	5	Vade	El Dorado	16
Two Rock	Sonoma	2	Val Verde Park	Los Angeles	9
			Valencia	Los Angeles	9
U			Valinda	Los Angeles	9
U.S. Navy Training Center	San Diego	7	Valle Vista	Riverside	10
U.S.M.C. Air Station, El Toro	Orange	8	Vallecito	Calaveras	12
U.S.M.C. Recruit Depot,	San Diego	7	Vallejo	Solano	3
U.S.N. Air Field, El Centro	Imperial	15	Valley Center	San Diego	10
U.S.N. Air Station, Alameda	Alameda	3	Valley Ford	Sonoma	2
U.S.N. Air Station, Imperial	San Diego	7	Valley Home	Stanislaus	12
U.S.N. Air Station, Lemoore	Kings	13	Valley Springs	Calaveras	12
U.S.N. Air Station, Los Alamitos	Orange	8	Valley Wells	Inyo	14
U.S.N. Air Station, North Island	San Diego	7	Valyermo	Los Angeles	14
U.S.N. Communication Station	San Joaquin	12	Van Nuys	Los Angeles	9
U.S.N. Construction Battalion	Ventura	6	Vandenberg Air Force Base	Santa Barbara	5
U.S.N. Facility, Point Sur	Monterey	3	Vandenburg Village	Santa Barbara	5
U.S.N. Facility, San Bruno	San Mateo	3	Venice	Los Angeles	6
U.S.N. Facility, San Clement Is.	Los Angeles	6	Ventupopa	Santa Barbara	4
U.S.N. Facility, San Nicolas Is.	Ventura	6	Ventura	Ventura	6
U.S.N. Facility, Sunnyvale	Santa Clara	4	Verdugo Mountains	Los Angeles	9
U.S.N. Facility, Vallejo	Solano	3	Vermilion Valley Dam	Fresno	16
U.S.N. Reservation, Point Loma	San Diego	7	Vernalis	San Joaquin	12
U.S.N. Shipyard, Long Beach	Los Angeles	6	Vernon	Los Angeles	8
U.S.N. Supply Center, Oakland	Alameda	3	Verona	Sutter	11
U.S.N. Weapons Station, Conc.	Contra Costa	12	Victor	San Joaquin	12
U.S.N. Weapons Station, Seal	Orange	6	Victorville	San Bernardino	14
UCLA	Los Angeles	9	Vidal	San Bernardino	15
Ukiah	Mendocino	2	Vidal Junction	San Bernardino	15
Union City	Alameda	3	Vidal Valley	San Bernardino	15
Union Valley Reservoir	El Dorado	16	Vidal Wash	San Bernardino	15
Unnamed Wash	Imperial	15	View Park	Los Angeles	9
Upland	San Bernardino	10	Viewland	Lassen	16
Upper Lake	Lake	2	Villa Park	Orange	8
Upper Lake	Modoc	16	Vina	Tehama	11
Upper San Leandro Reservoir	Alameda	3	Vinagre Wash	Imperial	15
Usona	Mariposa	13	Vincent	Los Angeles	14
			Vine Hill	Contra Costa	3
			Vineyard Canyon	Monterey	4
V			Vinton	Plumas	16
			Viola	Shasta	16

City	County	CZ	City	County	CZ
Vicalia	Tulare	13	West Hollywood	Los Angeles	9
Vista	San Diego	7	West Mesa	Imperial	15
Volcano	Amador	12	West Modesto	Stanislaus	12
Volcanoville	El Dorado	16	West Pittsburg	Contra Costa	12
Volta	Merced	12	West Point	Calaveras	12
Vorden	Sacramento	12	West Puente Valley	Los Angeles	9
W			West Sacramento	Yolo	12
			West Walker River	Mono	16
			West Whittier-Los Nietos	Los Angeles	9
Waddington	Humboldt	1	Westend	San Bernardino	14
Walker Pass	Kern	16	Westhaven	Fresno	13
Wallace	Calaveras	12	Westhaven	Humboldt	1
Walnut	Los Angeles	9	Westlake Village	Los Angeles	9
Walnut Creek	Contra Costa	12	Westley	Stanislaus	12
Walnut Grove	Sacramento	12	Westminster	Orange	6
Walnut Park	Los Angeles	8	Westmont	Los Angeles	8
Warner Mountains	Modoc	16	Westmorland	Imperial	15
Warner Springs	San Diego	14	Westport	Mendocino	1
Warnersville	Stanislaus	12	Westwood	Lassen	16
Wasco	Kern	13	Whale Rock Reservoir	San Luis Obispo	5
Washington	Nevada	16	Wheatland	Yuba	11
Waterford	Stanislaus	12	Wheeler Ridge	Kern	13
Waterloo	San Joaquin	12	Wheeler Springs	Ventura	16
Watson Wash	San Bernardino	14	Whipple Mountains	San Bernardino	15
Watsonville	Santa Cruz	3	Whiskeytown	Shasta	11
Waucoba Mountain	Inyo	16	Whiskeytown Lake	Shasta	11
Waucoba Wash	Inyo	16	White Horse	Modoc	16
Waukena	Tulare	13	White Mountain Peak	Mono	16
Wawona	Mariposa	16	White Mountains	Inyo	16
Weaverville	Trinity	16	White Mountains	Mono	16
Weed	Siskiyou	16	White River (Town)	Tulare	13
Weed Patch	Kern	13	White Rock	Sacramento	12
Weimar	Placer	11	White Water	Riverside	15
Weitchpec	Humboldt	2	White Wolf	Tuolumne	16
Weldon	Kern	16	Whitehorn	Humboldt	1
Wendel	Lassen	16	Whitehorse Flat Reservoir	Modoc	16
Weott	Humboldt	1	Whitewater River (North Fork)	San Bernardino	16
West Athens	Los Angeles	8	Whitewater River (South Fork)	San Bernardino	16
West Carson	Los Angeles	6	Whitley Gardens	San Luis Obispo	4
West Compton	Los Angeles	8	Whitney	Placer	11
West Covina	Los Angeles	9	Whittier	Los Angeles	9

City	County	CZ	City	County	CZ
Whittier Narrows Dam	Los Angeles	9	Woodville	Tulare	13
Wiest	Imperial	15	Woody	Kern	13
Wilbur Springs	Colusa	11	Wrightwood	San Bernardino	16
Wildomar	Riverside	10	Wunpost	Monterey	4
Wildrose RS	Inyo	16	Wyandotte	Butte	11
Williams	Colusa	11	Wynola	San Diego	14
Williams Peak	Mendocino	2	Wynton	Siskiyou	16
Willite	Mendocino	2			
Willow Creek	Humboldt	2	Y		
Willow Brook	Los Angeles	8			
Willow Creek Camp	Inyo	16	Yermo	San Bernardino	14
Willow Ranch	Modoc	16	Yottem	Tulare	13
Willow Springs	Kern	14	Yolo	Yolo	12
Willow Wash	San Bernardino	14	Yolo Bypass	Selma	12
Willowbrook	Los Angeles	8	Yolo Bypass	Yolo	12
Willows	Glenn	11	Yorba Linda	Orange	8
Wilseyville	Calaveras	12	Yorkville	Mendocino	2
Wilsona Gardens	Los Angeles	14	Yosemite Valley	Mariposa	16
Wilsonia	Tulare	16	Yosemite Village	Mariposa	16
Wilton	Sacramento	12	Yountville	Napa	2
Winchester	Riverside	10	Yreka	Siskiyou	16
Windsor	Sonoma	2	Yuba City	Sutter	11
Wingate Wash	Inyo	14	Yucaipa	San Bernardino	10
Winston Wash	San Bernardino	14	Yucca Mountain	Tulare	16
Winterhaven	Imperial	15	Yucca Valley	San Bernardino	14
Winters	Yolo	12	Yuba Desert	Imperial	15
Winton	Merced	12			
Wishin	Madera	16	Z		
Wishin Reservoir	Fresno	16			
Wister	Imperial	15	Zamora	Yolo	12
Wofford Heights	Kern	16	Zenia	Trinity	2
Woodacre	Marin	2	Zuma Canyon	Los Angeles	6
Woodbridge	San Joaquin	12			
Woodcrest	Riverside	10			
Woodfords	Alpine	16			
Woodlake	Tulare	13			
Woodland	Yolo	12			
Woodland Hills	Los Angeles	9			
Woodleaf	Yuba	16			
Woodman	Mendocino	2			
Woodside	San Mateo	3			

JA2.2 California Design Location Data

The data contained in the following table was obtained through a joint effort by the Southern California Chapter and the Golden Gate Chapter of ASHRAE. It is reprinted here with the written permission of Southern California Chapter ASHRAE, Inc. The values for 1.0 percent drybulb and 1.0 percent mean coincident wetbulb (MCWB) are interpolated.¹

The data in Table 2-3 is developed from A full listing of design location data for California is contained in the ASHRAE publication *SPCDX, Climate Data for Region X, Arizona, California, Hawaii, and Nevada* (ISBN 200021, May 1982) and *Supplement to Climatic Data for Region X, Arizona, California, Hawaii, Nevada* (ISBN 20002956, November 1994). The publication may be ordered from:

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¹ The interpolation formula is $2.0\%value + 0.6667 (0.5\%Value - 2.0\% value + 0.5)$.

Table 2-3 – Design Day Data for California Cities

City	Climate Zone	Latitude	Elevation (ft)	Longitude	Cooling								Heating						
					0.10%		0.50%		1.00%		2.00%		Design Wetbulb 0.1%	Design Wetbulb 0.5%	Outdoor Daily Range	Winter Median of Extremes	Design Drybulb (0.2%)	Design Drybulb (0.6%)	HDD*
					DB	MCWB	DB	MCWB	DB	MCWB	DB	MCWB							
Adelanto	14	34.6	2865	117.4	105	67	101	65	100	64	97	62	70	68	39	14	24	27	1654
Adin RS	16	41.2	4195	121	96	61	92	60	91	60	88	59	65	63	43	-7	-2	4	
Agoura Hills	9	34.2	700	118.8	103	70	96	68	94	68	90	66	73	71	29	27	31	34	
Alameda NAS	3	37.8	15	122.3	88	65	82	64	80	64	76	62	66	64	21	35	38	40	2507
Alamo	12	37.9	410	122.9	102	69	97	68	96	68	92	66	72	70	30	23	28	31	
Albany	3	37.9	40	122.3	88	65	83	64	81	64	77	62	66	64	16	30	35	38	
Alderpoint	2	40.2	460	123.6	100	69	95	67	94	67	90	65	70	68	39	21	27	30	3424
Alhambra	9	34	483	118.1	100	71	96	70	94	70	90	68	73	71	25	30	35	37	
Aliso Viejo	6	33.6	50	117.7	91	69	83	68	81	68	76	66	71	69	18	30	33	36	
Almaden AFS	4	37.2	3470	121.9	95	62	90	60	89	60	85	59	64	62	20	20	25	29	4468
Alondra Park	8	33.9	50	118.3	91	69	86	68	85	68	81	66	71	69	17	35	40	42	
Alpine	10	32.8	1735	116.8	99	69	95	68	94	68	91	67	72	70	35	27	32	35	
Alta Sierra	16	35.7	6500	118.6	87	62	84	61	83	61	80	59	65	63	32	-4	1	8	2428
Altadena	9	34.2	1200	118.1	99	68	94	67	92	67	88	66	72	70	31	32	37	39	1920
Alturas RS	16	41.5	4400	120.6	99	62	96	61	95	61	91	59	65	63	43	-10	-4	0	6895
Alum Rock	4	37.4	70	121.8	95	68	90	66	88	66	84	64	70	68	22	28	33	36	
American Canyon	2	37.6	85	122.3	93	67	90	66	88	66	84	64	70	68	23	28	33	36	
Anaheim	8	33.8	158	117.9	99	69	92	68	90	68	85	67	73	71	26	32	37	39	
Anderson	11	40.5	430	122.3	107	71	103	70	101	70	97	68	72	70	30	26	31	34	
Angwin	2	38.6	1815	122.4	98	66	93	64	92	64	88	62	69	66	33	25	30	33	
Antioch	12	38	60	121.8	102	70	97	68	95	68	91	66	70	69	34	22	28	31	2627
Apple Valley	14	34.5	2935	117.2	105	66	101	65	100	65	97	64	70	68	38	14	21	25	

City	Climate Zone	Latitude	Elevation (ft)	Longitude	Cooling								Heating						
					0.10%		0.50%		1.00%		2.00%		Design Wetbulb 0.1%	Design Wetbulb 0.5%	Outdoor Daily Range	Winter Median of Extremes	Design Drybulb (0.2%)	Design Drybulb (0.6%)	HDD*
					DB	MCWB	DB	MCWB	DB	MCWB	DB	MCWB							
<u>Aptos</u>	<u>3</u>	<u>37</u>	<u>500</u>	<u>121.9</u>	<u>94</u>	<u>67</u>	<u>88</u>	<u>66</u>	<u>87</u>	<u>65</u>	<u>83</u>	<u>63</u>	<u>69</u>	<u>67</u>	<u>30</u>	<u>27</u>	<u>32</u>	<u>35</u>	
<u>Arcadia</u>	<u>9</u>	<u>34.2</u>	<u>475</u>	<u>118</u>	<u>100</u>	<u>69</u>	<u>96</u>	<u>68</u>	<u>95</u>	<u>68</u>	<u>91</u>	<u>67</u>	<u>73</u>	<u>71</u>	<u>30</u>	<u>31</u>	<u>36</u>	<u>38</u>	
<u>Arcata</u>	<u>1</u>	<u>41</u>	<u>218</u>	<u>124.1</u>	<u>75</u>	<u>61</u>	<u>69</u>	<u>59</u>	<u>68</u>	<u>59</u>	<u>65</u>	<u>58</u>	<u>61</u>	<u>60</u>	<u>11</u>	<u>28</u>	<u>31</u>	<u>33</u>	<u>5029</u>
<u>Arden</u>	<u>12</u>	<u>38.5</u>	<u>80</u>	<u>121.4</u>	<u>104</u>	<u>70</u>	<u>100</u>	<u>69</u>	<u>98</u>	<u>69</u>	<u>94</u>	<u>67</u>	<u>73</u>	<u>71</u>	<u>35</u>	<u>28</u>	<u>33</u>	<u>35</u>	
<u>Arroyo Grande</u>	<u>5</u>	<u>35.1</u>	<u>105</u>	<u>120.6</u>	<u>92</u>	<u>66</u>	<u>86</u>	<u>64</u>	<u>84</u>	<u>64</u>	<u>79</u>	<u>62</u>	<u>67</u>	<u>65</u>	<u>18</u>	<u>28</u>	<u>32</u>	<u>35</u>	
<u>Artesia</u>	<u>8</u>	<u>33.8</u>	<u>50</u>	<u>118.1</u>	<u>99</u>	<u>71</u>	<u>91</u>	<u>70</u>	<u>89</u>	<u>70</u>	<u>85</u>	<u>68</u>	<u>73</u>	<u>71</u>	<u>23</u>	<u>33</u>	<u>37</u>	<u>40</u>	
<u>Arvin</u>	<u>13</u>	<u>35.2</u>	<u>445</u>	<u>118.8</u>	<u>106</u>	<u>71</u>	<u>102</u>	<u>69</u>	<u>101</u>	<u>69</u>	<u>98</u>	<u>68</u>	<u>74</u>	<u>72</u>	<u>30</u>	<u>26</u>	<u>29</u>	<u>32</u>	
<u>Ash Mtn</u>	<u>13</u>	<u>36.5</u>	<u>1708</u>	<u>118.8</u>	<u>105</u>	<u>69</u>	<u>101</u>	<u>68</u>	<u>100</u>	<u>68</u>	<u>97</u>	<u>66</u>	<u>72</u>	<u>70</u>	<u>30</u>	<u>25</u>	<u>31</u>	<u>33</u>	<u>2703</u>
<u>Ashland</u>	<u>3</u>	<u>37.7</u>	<u>45</u>	<u>122.1</u>	<u>92</u>	<u>66</u>	<u>86</u>	<u>65</u>	<u>85</u>	<u>64</u>	<u>81</u>	<u>62</u>	<u>68</u>	<u>66</u>	<u>24</u>	<u>26</u>	<u>31</u>	<u>34</u>	<u>977</u>
<u>Atascadero</u>	<u>4</u>	<u>35.5</u>	<u>837</u>	<u>120.7</u>	<u>94</u>	<u>66</u>	<u>89</u>	<u>67</u>	<u>88</u>	<u>67</u>	<u>84</u>	<u>65</u>	<u>70</u>	<u>68</u>	<u>42</u>	<u>25</u>	<u>29</u>	<u>32</u>	
<u>Atherton</u>	<u>3</u>	<u>37.5</u>	<u>50</u>	<u>122.2</u>	<u>90</u>	<u>66</u>	<u>84</u>	<u>64</u>	<u>82</u>	<u>64</u>	<u>78</u>	<u>62</u>	<u>68</u>	<u>66</u>	<u>27</u>	<u>23</u>	<u>29</u>	<u>33</u>	
<u>Atwater</u>	<u>12</u>	<u>37.3</u>	<u>150</u>	<u>120.6</u>	<u>102</u>	<u>72</u>	<u>99</u>	<u>70</u>	<u>98</u>	<u>69</u>	<u>94</u>	<u>67</u>	<u>74</u>	<u>72</u>	<u>38</u>	<u>24</u>	<u>30</u>	<u>34</u>	
<u>Auberry</u>	<u>16</u>	<u>37.1</u>	<u>2140</u>	<u>119.5</u>	<u>102</u>	<u>69</u>	<u>98</u>	<u>67</u>	<u>97</u>	<u>66</u>	<u>95</u>	<u>64</u>	<u>71</u>	<u>69</u>	<u>36</u>	<u>21</u>	<u>27</u>	<u>30</u>	<u>3313</u>
<u>Auburn</u>	<u>11</u>	<u>38.9</u>	<u>1292</u>	<u>121.1</u>	<u>103</u>	<u>69</u>	<u>100</u>	<u>67</u>	<u>99</u>	<u>67</u>	<u>95</u>	<u>66</u>	<u>72</u>	<u>69</u>	<u>33</u>	<u>25</u>	<u>30</u>	<u>33</u>	<u>3089</u>
<u>Avalon</u>	<u>6</u>	<u>33.4</u>	<u>25</u>	<u>118.3</u>	<u>83</u>	<u>64</u>	<u>75</u>	<u>62</u>	<u>73</u>	<u>62</u>	<u>69</u>	<u>60</u>	<u>68</u>	<u>66</u>	<u>11</u>	<u>37</u>	<u>41</u>	<u>44</u>	<u>2204</u>
<u>Avenal</u>	<u>13</u>	<u>36</u>	<u>550</u>	<u>120.1</u>	<u>103</u>	<u>70</u>	<u>98</u>	<u>70</u>	<u>97</u>	<u>70</u>	<u>93</u>	<u>69</u>	<u>73</u>	<u>72</u>	<u>34</u>	<u>23</u>	<u>28</u>	<u>31</u>	
<u>Avocado Heights</u>	<u>9</u>	<u>34.2</u>	<u>550</u>	<u>118</u>	<u>101</u>	<u>69</u>	<u>97</u>	<u>68</u>	<u>95</u>	<u>68</u>	<u>91</u>	<u>68</u>	<u>74</u>	<u>72</u>	<u>30</u>	<u>28</u>	<u>32</u>	<u>35</u>	<u>741</u>
<u>Azusa</u>	<u>9</u>	<u>34.1</u>	<u>605</u>	<u>118.2</u>	<u>101</u>	<u>70</u>	<u>97</u>	<u>69</u>	<u>95</u>	<u>69</u>	<u>91</u>	<u>68</u>	<u>74</u>	<u>72</u>	<u>36</u>	<u>31</u>	<u>36</u>	<u>38</u>	
<u>Baker</u>	<u>14</u>	<u>35.3</u>	<u>940</u>	<u>116.1</u>	<u>115</u>	<u>73</u>	<u>112</u>	<u>72</u>	<u>111</u>	<u>72</u>	<u>108</u>	<u>70</u>	<u>77</u>	<u>75</u>	<u>29</u>	<u>23</u>	<u>28</u>	<u>31</u>	
<u>Bakersfield AP</u>	<u>13</u>	<u>35.4</u>	<u>475</u>	<u>119.1</u>	<u>106</u>	<u>71</u>	<u>102</u>	<u>70</u>	<u>101</u>	<u>70</u>	<u>98</u>	<u>68</u>	<u>74</u>	<u>72</u>	<u>34</u>	<u>26</u>	<u>31</u>	<u>35</u>	<u>2185</u>
<u>Balch PH</u>	<u>14</u>	<u>36.9</u>	<u>1720</u>	<u>116.0</u>	<u>100</u>	<u>67</u>	<u>97</u>	<u>66</u>	<u>96</u>	<u>66</u>	<u>93</u>	<u>64</u>	<u>71</u>	<u>69</u>	<u>26</u>	<u>26</u>	<u>31</u>	<u>34</u>	
<u>Baldwin Park</u>	<u>9</u>	<u>34</u>	<u>394</u>	<u>118</u>	<u>100</u>	<u>69</u>	<u>96</u>	<u>69</u>	<u>94</u>	<u>69</u>	<u>90</u>	<u>68</u>	<u>73</u>	<u>72</u>	<u>32</u>	<u>31</u>	<u>36</u>	<u>38</u>	
<u>Banning</u>	<u>15</u>	<u>33.9</u>	<u>2349</u>	<u>116.9</u>	<u>104</u>	<u>69</u>	<u>100</u>	<u>68</u>	<u>99</u>	<u>68</u>	<u>96</u>	<u>67</u>	<u>73</u>	<u>71</u>	<u>34</u>	<u>20</u>	<u>26</u>	<u>30</u>	
<u>Barrett Dam</u>	<u>10</u>	<u>32.7</u>	<u>1623</u>	<u>116.7</u>	<u>103</u>	<u>69</u>	<u>97</u>	<u>68</u>	<u>96</u>	<u>68</u>	<u>92</u>	<u>67</u>	<u>73</u>	<u>71</u>	<u>35</u>	<u>22</u>	<u>26</u>	<u>28</u>	<u>2656</u>
<u>Barstow</u>	<u>14</u>	<u>34.9</u>	<u>2162</u>	<u>117</u>	<u>107</u>	<u>69</u>	<u>104</u>	<u>69</u>	<u>103</u>	<u>69</u>	<u>100</u>	<u>67</u>	<u>74</u>	<u>72</u>	<u>35</u>	<u>16</u>	<u>23</u>	<u>27</u>	<u>2580</u>

City	Climate Zone	Latitude	Elevation (ft)	Longitude	Cooling								Heating						
					0.10%		0.50%		1.00%		2.00%		Design Wetbulb 0.1%	Design Wetbulb 0.5%	Outdoor Daily Range	Winter Median of Extremes	Design Drybulb (0.2%)	Design Drybulb (0.6%)	HDD*
					DB	MCWB	DB	MCWB	DB	MCWB	DB	MCWB							
Baywood-Los Osos	5	35.3	100		88	65	82	64	80	64	76	62	67	65	14	31	36	38	
Beale AFB	11	39.1	113	121.4	105	71	102	70	101	70	97	68	74	72	34	25	28	30	2835
Beaumont	10	33.9	2605	117	103	68	99	67	98	67	95	66	72	70	38	22	27	30	2628
Bell	8	33.9	143	118.2	97	70	91	69	89	69	85	67	72	70	22	33	38	41	
Bell Gardens	8	33.9	160	118.2	97	70	91	69	87	67	85	67	72	70	22	32	37	40	
Bellflower	8	33.8	73	118.1	98	70	91	69	89	69	85	67	72	70	21	32	37	40	
Belmont	3	37.5	33	122.3	90	66	84	64	82	64	78	62	68	66	24	29	34	36	
Ben Lomond	3	37.1	450	122.1	92	67	85	66	83	65	79	63	69	67	30	25	30	33	
Benicia	12	38.1	55	122.1	99	69	93	67	91	67	87	65	70	68	30	28	33	36	
Berkeley	3	37.9	345	122.3	90	64	83	63	81	63	76	61	66	64	16	33	37	40	2950
Berryessa Lake	2	38.6	480	122.1	102	70	98	69	96	69	92	67	72	70	35	26	31	34	
Beverly Hills	9	34.1	268	118.2	94	69	88	68	87	68	83	66	71	69	20	39	43	46	
Big Bar RS	16	40.8	1260	121.8	102	68	98	67	97	67	93	65	70	68	46	19	25	28	
Big Bear Lake	16	34.2	6745	116.9	87	59	83	58	82	58	79	56	64	62	32	-3	3	7	6850
Bishop AP	16	37.4	4108	118.4	103	61	100	60	99	60	97	58	65	63	40	5	12	16	4313
Blackhawk	12	37.7	10	121.9	88	65	82	64	80	64	76	62	66	64	21	35	38	40	977
Blackwells Corner	13	35.6	644	119.9	99	68	94	66	93	66	89	65	71	69	31	23	28	32	
Bloomington	10	34	980	117.4	106	71	102	70	101	70	98	69	75	73	34	30	35	38	
Blue Canyon AP	16	39.3	5280	120.7	88	60	85	59	84	59	81	57	64	62	20	13	20	24	5704
Blythe AP	15	33.6	395	114.7	115	74	112	73	111	73	108	71	80	78	27	28	33	36	1219
Blythe CO	15	33.6	268	114.6	115	74	112	73	111	73	108	71	80	78	27	24	29	32	1312
Boca	16	39.4	5575	120.1	92	58	89	57	88	57	84	55	62	60	46	-18	-13	-10	8340
Bodie	16	38.2	8370	119	83	50	80	49	79	49	76	48	55	53	42	-21	-16	-13	
Bonadella Ranchos – Madera Rancho	13	36.8	270	119.9	105	72	101	70	100	70	96	68	74	72	40		29	32	1273

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					0.10%		0.50%		1.00%		2.00%		Design Wetbulb 0.1%	Design Wetbulb 0.5%	Outdoor Daily Range	Winter Median of Extremes	Design Drybulb (0.2%)	Design Drybulb (0.6%)	HDD*
					DB	MCWB	DB	MCWB	DB	MCWB	DB	MCWB							
Bonita	7	32.7	105	117	91	69	82	67	81	66	78	64	70	68	20	28	32	44	1864
Boron AFS	14	35.1	3015	117.6	106	70	103	69	102	69	98	68	73	71	35	18	23	26	3000
Borrego Desert PK	15	33.2	805	116.4	112	76	107	74	105	74	101	72	79	77	36	25	30	33	
Bostonia	10	32.8	600	116.9	96	70	91	69	88	69	81	67	72	70	30	29	34	36	
Boulder Creek	3	37.2	493	122.1	92	67	85	65	83	65	79	63	69	67	30	25	30	33	1120
Bowman Dam	16	39.4	5347	120.7	89	59	86	57	85	57	82	55	63	60	26	9	17	22	5964
Boyes Hot Sprgs	2	38.2	300	122.5	100	70	95	69	93	69	89	67	72	70	40	22	28	31	1289
Brannan Island	12	38.1	30	121.7	100	69	95	68	93	68	89	67	72	70	10	24	28	31	
Brawley 2 SW	15	33	-100	115.6	113	74	110	73	109	73	105	73	81	79	32	25	30	33	1204
Brea Dam	8	33.9	275	117.9	100	69	94	68	92	68	86	66	73	71	29	30	34	37	
Brentwood	12	37.9	71	121.7	102	70	97	68	95	67	89	65	71	68	34	27	32	35	
Bridgeport	16	38.2	6470	119.2	89	56	86	54	85	54	82	53	60	57	41	-20	-15	-12	
Broderick-Bryte	12	38.6	20	121.5	104	71	100	69	98	69	94	67	72	71	36	25	31	35	
Brooks Ranch	12	38.8	294	122.2	104	71	99	70	97	70	93	68	73	71	35	19	25	28	2968
Buena Park	8	33.9	75	118	98	69	92	68	90	68	85	67	72	70	25	31	35	38	
Burbank AP	9	34.2	699	118.4	101	70	96	68	94	68	90	67	72	70	28	29	34	36	1701
Burbank Vly Pump	9	34.2	655	118.4	101	69	96	68	94	68	90	66	72	70	28	29	34	36	1678
Burlingame	3	37.6	10	122.4	88	67	82	64	80	64	76	63	68	65	20	30	35	37	
Burney	16	40.9	3127	121.7	95	64	92	63	91	63	88	61	67	65	42	0	5	12	6404
Butler Valley (Korbel)	1	40.7	420	123.9	91	66	86	64	85	64	81	62	67	65	22	20	26	29	
Buttonwillow	13	35.4	269	119.5	103	71	99	70	98	70	95	68	74	72	36	20	26	29	2621
Cabrillo NM	7	32.7	410	117.2	89	69	84	68	83	68	80	67	71	69	12	39	43	45	
Cachuma Lake	5	34.6	781	120	97	69	92	67	91	67	87	65	70	68	19	26	31	34	
Calabasas	9	34.2	1100	118.6	102	71	98	70	97	70	93	69	73	71	26	26	30	33	2348
Calaveras Big Trees	16	38.3	4696	120.3	92	61	88	60	87	60	84	58	64	62	33	11	18	23	5848

City	Climate Zone	Latitude	Elevation (ft)	Longitude	Cooling								Heating						
					0.10%		0.50%		1.00%		2.00%		Design Wetbulb 0.1%	Design Wetbulb 0.5%	Outdoor Daily Range	Winter Median of Extremes	Design Drybulb (0.2%)	Design Drybulb (0.6%)	HDD*
					DB	MCWB	DB	MCWB	DB	MCWB	DB	MCWB							
Calexico	15	32.7	12	115.5	114	74	110	73	109	73	106	71	81	79	28	26	31	34	
California City	14	35.1	2400	118	107	69	104	68	103	68	99	66	72	70	33	10	17	22	2572
Callahan	16	41.3	3185	122.8	97	63	93	62	92	62	88	60	66	64	35	7	15	20	
Calwa	13	36.8	330	119.8	105	73	101	71	100	70	97	68	75	73	34	23	27	29	
Camarillo	6	34.2	147	119.2	91	69	84	68	82	68	78	67	71	69	22	28	32	35	
Cambria AFS	5	35.5	690	121.1	78	62	72	61	70	61	66	59	64	62	16	30	35	38	3646
Cameron Park	12	38.6	1800	121	101	67	98	66	97	66	93	65	70	68	42	20	26	29	2235
Camp Pardee	12	38.2	658	120.9	106	71	103	70	102	70	98	69	74	72	36	27	32	35	2812
Camp Pendleton	7	33.4	50	117.4	88	69	85	68	84	68	80	67	71	69	12	34	38	40	
Camp Roberts	4	35.8	765	120.8	106	72	101	71	99	71	95	69	74	72	45	16	24	27	2890
Campbell	4	37.3	195	121.8	93	69	88	66	87	66	83	65	71	68	30	28	33	36	
Campo	14	32.6	2630	116.5	101	67	95	66	94	66	90	66	71	69	41	16	23	27	3303
Canoga Park	9	34.2	790	118.6	104	71	99	70	97	70	93	69	74	72	38	25	30	33	1884
Cantil	14	35.3	2010	118	111	71	107	71	106	71	103	70	74	73	32	12	19	24	
Canyon Dam	16	40.1	4555	121.1	93	60	90	59	89	59	85	57	64	62	39	1	6	13	6834
Canyon Lake	10	33.8	1500	117.3	105	70	101	69	100	69	97	68	74	72	39	22	27	30	
Capitola	3	37	64	122	94	67	88	66	86	65	81	63	69	67	24	27	32	35	
Cardiff-by-the-Sea	7	33	80	117.3	87	68	83	67	81	67	77	65	70	68	12	35	39	41	
Carlsbad	7	33.2	44	117.4	87	68	83	67	81	67	77	65	70	68	10	34	38	40	
Carmel Valley	3	36.5	425	121.7	94	68	88	66	86	66	80	65	69	67	20	25	30	33	
Carmel-by-the-Sea	3	36.5	20	121.9	87	65	78	62	76	62	71	61	66	63	20	30	35	38	968
Carmichael	12	38.6	100	121.5	104	70	100	69	98	69	94	68	73	71	35	25	35	37	1290
Carpinteria	6	34.4	385	119.5	90	69	83	67	81	67	77	65	70	68	15	30	34	37	
Carson	6	33.8	60	118.3	96	69	88	68	86	68	82	66	71	69	19	33	38	40	

City	Climate Zone	Latitude	Elevation (ft)	Longitude	Cooling								Heating						
					0.10%		0.50%		1.00%		2.00%		Design Wetbulb 0.1%	Design Wetbulb 0.5%	Outdoor Daily Range	Winter Median of Extremes	Design Drybulb (0.2%)	Design Drybulb (0.6%)	HDD*
					DB	MCWB	DB	MCWB	DB	MCWB	DB	MCWB							
Casa de Oro-Mount Helix	10	32.7	530	117.0	96	71	88	69	87	69	84	67	72	70	19	34	38	41	404
Castle AFB	12	37.4	188	120.6	105	71	101	70	100	70	96	69	73	71	33	24	28	31	2590
Castro Valley	3	37.6	177	122.2	93	67	87	67	85	67	80	65	69	68	25	24	29	32	
Castroville	3	36.8	20	121.8	86	66	77	63	75	63	70	61	67	64	18	32	37	40	1151
Cathedral City	15	33.8	400	116.5	117	74	113	73	112	73	109	72	79	78	33	26	31	34	374
Catheys Valley	12	37.4	1000	120.1	102	69	99	68	98	68	94	67	72	70	38	21	27	30	
Cecilville	16	41.1	3000	123.1	95	63	89	62	88	61	84	59	65	63	44	13	20	24	
Cedarville	16	41.5	4670	120.2	97	61	94	60	93	60	89	58	65	63	35	1	6	13	6304
Centerville PH	11	39.8	522	121.7	105	70	100	68	99	68	96	67	72	70	40	25	30	33	2895
Ceres	12	37.6	90	121	101	72	96	70	94	69	90	67	74	72	36	24	30	34	
Cerritos	8	33.9	34	118.1	99	71	92	69	90	69	85	68	73	71	23	33	38	40	
Charter Oak	9	34.1	600	117.9	101	70	97	69	95	69	91	68	74	72	34	29	34	36	
Chatsworth	9	34.2	964	118.6	98	69	93	68	91	68	87	66	72	70	38	26	31	34	664
Cherry Valley Dam	16	38	4765	119.9	96	62	92	61	91	61	88	59	65	63	32	9	16	21	
Cherryland	3	37.5	100	122.1	93	67	86	66	84	66	79	64	69	67	24	26	31	37	
Chester	16	40.3	4525	121.2	94	62	91	61	90	61	86	59	65	63	33	-3	2	8	
Chico Exp Sta	11	39.7	205	121.8	105	70	102	69	100	69	96	68	72	71	37	22	27	30	2878
China Lake	14	35.7	2220	117.7	112	70	108	68	107	68	104	68	74	72	33	15	22	25	2560
Chino	10	34	714	117.7	104	70	100	69	98	69	94	68	74	72	35	27	32	35	
Chino Hills	10	34.1	800	117.7	104	70	100	69	98	69	94	68	74	72	35	27	32	35	800
Chowchilla	13	37	200	120.3	104	72	101	70	100	70	96	68	74	72	38	22	28	31	1250
Chula Vista	7	32.6	9	117.1	90	70	84	68	83	68	79	66	71	69	9	33	38	40	2072
Citrus Heights	12	38.7	138	121.5	104	71	100	70	98	70	94	68	74	72	36	24	26	29	
Claremont	9	34.1	1201	117.8	101	69	97	68	95	68	91	66	73	71	34	29	34	36	2049

City	Climate Zone	Latitude	Elevation (ft)	Longitude	Cooling								Heating						
					0.10%		0.50%		1.00%		2.00%		Design Wetbulb 0.1%	Design Wetbulb 0.5%	Outdoor Daily Range	Winter Median of Extremes	Design Drybulb (0.2%)	Design Drybulb (0.6%)	HDD*
					DB	MCWB	DB	MCWB	DB	MCWB	DB	MCWB							
Clarksburg	12	38.4	14	121.5	102	70	97	69	95	69	91	67	72	70	35	24	29	32	2971
Clayton	12	38	60	121.9	102	70	97	68	95	67	89	65	71	68	34	27	32	35	
Clearlake Highlands	2	39	1360	122.7	101	69	97	68	95	67	89	65	71	69	36	15	22	26	
Cloverdale	2	38.8	320	123	102	70	97	69	95	68	89	66	72	70	37	26	31	34	2763
Clovis	13	36.8	404	119.7	105	72	102	70	101	70	98	68	74	72	36	22	28	32	
Coachella	15	33.7	-76	116.2	114	74	110	73	109	73	106	73	80	79	28	25	30	34	
Coalinga	13	36.2	671	120.4	103	70	98	70	97	70	93	69	73	72	34	23	28	31	2592
Colfax	11	39.1	2418	121	100	66	97	65	96	65	92	63	69	67	29	22	28	31	3424
Colton	10	34.1	978	117.3	105	70	102	68	101	68	97	67	74	72	35	28	33	36	
Colusa	11	39.2	60	122	103	72	100	70	98	70	94	68	74	71	36	23	29	31	2793
Commerce	8	33.9	175	118.2	98	69	92	68	90	68	86	67	72	70	23	33	37	39	
Compton	8	33.9	71	118.2	97	69	90	68	88	68	83	67	72	70	21	33	37	39	1606
Concord	12	38	195	112	102	70	97	68	95	67	89	65	71	68	34	27	32	35	3035
Corcoran	13	36.1	200	119.7	106	72	102	71	101	71	98	70	74	73	36	22	28	31	2666
Corning	11	39.9	487	122.2	106	71	103	70	102	69	98	67	73	71	33	23	28	31	1330
Corona	10	33.9	710	117.6	104	70	100	69	98	69	92	67	74	72	35	26	31	34	1794
Coronado	7	32.7	20	117.2	89	69	82	67	80	67	76	65	70	68	10	36	39	41	1500
Corte Madera	3	37.9	55	122.5	97	68	91	66	89	66	84	64	69	68	34	28	33	35	
Costa Mesa	6	33.7	100	117.9	88	68	81	66	79	66	73	65	70	68	16	31	36	38	1482
Cotati	2	38.3	100	122.7	99	69	94	68	93	68	89	66	71	69	32	24	28	30	1205
Country Club	12	37.8	600	121.3	102	69	97	68	96	68	92	66	72	70	30	68	28	31	977
Covelo	2	39.8	1385	123.3	99	67	93	65	91	65	87	63	69	67	43	15	22	26	4179
Covina	9	34.1	575	117.9	101	70	97	69	95	69	91	68	74	72	34	29	34	36	
Crescent City	1	41.8	40	124.2	75	61	69	59	68	59	65	58	61	60	18	28	33	36	4445
Crestline	16	34.2	4900	117.3	90	62	86	61	85	61	81	59	66	64	26	13	20	24	3200

City	Climate Zone	Latitude	Elevation (ft)	Longitude	Cooling								Heating						
					0.10%		0.50%		1.00%		2.00%		Design Wetbulb 0.1%	Design Wetbulb 0.5%	Outdoor Daily Range	Winter Median of Extremes	Design Drybulb (0.2%)	Design Drybulb (0.6%)	HDD*
					DB	MCWB	DB	MCWB	DB	MCWB	DB	MCWB							
Crockett	12	38	9	122.2	96	68	90	66	89	66	85	64	70	67	23	28	33	36	
Crows Landing	12	37.4	140	121.1	101	70	96	68	94	68	89	66	72	70	33	23	28	31	2767
Cucamonga	10	34.1	1450	117.6	103	69	99	68	97	67	93	65	73	71	31	29	34	36	
Cudahy	8	33.9	130	118.2	98	70	91	69	89	69	85	67	72	70	21	33	37	39	
Culver City	8	34	106	118.4	96	70	88	69	87	69	83	67	72	70	18	35	40	42	1515
Cupertino	4	37.3	70	122	96	68	88	67	86	66	80	64	70	68	30	28	33	36	
Cuyama	4	34.9	2255	116.6	99	68	96	67	94	67	89	66	72	70	42	13	20	24	
Cuyamaca	14	33	4650	116.6	92	64	85	62	84	61	81	59	67	65	29	11	18	23	4848
Cypress	8	33.8	75	118	98	70	92	69	90	69	85	67	72	70	24	31	35	38	
Daggett AP	14	34.9	1915	116.8	109	68	106	68	105	68	102	66	73	72	33	21	26	29	2203
Daly City	3	37.6	410	122.5	84	65	78	62	77	62	73	61	66	63	16	34	37	39	
Dana Point	6	33.5	100	117.7	91	69	84	68	82	68	78	66	71	69	13	30	33	36	600
Danville	12	37.8	368	122	102	69	97	68	96	68	92	66	72	70	30	23	28	31	977
Davis	12	38.5	60	121.8	103	72	99	70	97	70	93	68	74	71	41	24	30	34	2844
De Sabla	11	39.9	2713	121.6	97	66	94	64	92	64	88	62	68	66	35	18	24	27	4237
Death Valley	14	36.5	-194	116.9	121	77	118	76	117	76	114	74	81	79	28	27	33	37	1147
Deep Springs Clg	16	37.5	5225	118	98	60	95	59	94	59	92	58	64	62	35	-3	2	8	
Deer Creek PH	11	39.3	4455	120.9	93	61	91	60	90	60	87	58	65	63	39	10	17	22	5863
Del Aire	6	34	100	118.4	91	69	84	67	83	67	79	66	71	69	15	37	40	42	383
Delano	13	35.8	323	119.3	106	71	102	70	101	70	98	69	74	72	36	22	25	28	
Denair	12	37.6	137	120.8	100	70	95	69	93	69	89	67	72	70	38	22	28	31	2974
Desert Hot Springs	15	34	1060	116.5	115	73	111	72	110	72	107	71	78	77	35	24	29	32	400
Diamond Bar	9	34	880	117.8	101	69	97	68	96	68	92	66	73	71	33	28	33	35	
Dinuba	13	36.5	340	119.4	104	73	101	70	100	70	96	69	75	73	36	24	30	34	
Discovery Bay	12	38.1	10	121.6	102	70	97	68	95	67	89	65	71	68	34	27	32	35	

City	Climate Zone	Latitude	Elevation (ft)	Longitude	Cooling								Heating						
					0.10%		0.50%		1.00%		2.00%		Design Wetbulb 0.1%	Design Wetbulb 0.5%	Outdoor Daily Range	Winter Median of Extremes	Design Drybulb (0.2%)	Design Drybulb (0.6%)	HDD*
					DB	MCWB	DB	MCWB	DB	MCWB	DB	MCWB							
<u>Dixon</u>	<u>12</u>	<u>38.4</u>	<u>100</u>	<u>121.9</u>	<u>104</u>	<u>72</u>	<u>99</u>	<u>70</u>	<u>97</u>	<u>70</u>	<u>93</u>	<u>68</u>	<u>74</u>	<u>71</u>	<u>36</u>	<u>24</u>	<u>30</u>	<u>33</u>	<u>2826</u>
<u>Dobbins</u>	<u>11</u>	<u>39.4</u>	<u>1640</u>	<u>121.2</u>	<u>104</u>	<u>70</u>	<u>101</u>	<u>68</u>	<u>100</u>	<u>68</u>	<u>96</u>	<u>67</u>	<u>72</u>	<u>70</u>	<u>31</u>	<u>24</u>	<u>29</u>	<u>32</u>	
<u>Donner Mem Stt Pk</u>	<u>16</u>	<u>39.3</u>	<u>5937</u>	<u>120.3</u>	<u>85</u>	<u>56</u>	<u>82</u>	<u>56</u>	<u>81</u>	<u>56</u>	<u>77</u>	<u>54</u>	<u>60</u>	<u>58</u>	<u>40</u>	<u>-3</u>	<u>3</u>	<u>6</u>	
<u>Donner Summit</u>	<u>16</u>	<u>39.4</u>	<u>7239</u>	<u>120.3</u>	<u>80</u>	<u>53</u>	<u>77</u>	<u>53</u>	<u>76</u>	<u>52</u>	<u>72</u>	<u>50</u>	<u>57</u>	<u>55</u>	<u>40</u>	<u>-8</u>	<u>-1</u>	<u>3</u>	<u>8290</u>
<u>Downey</u>	<u>8</u>	<u>33.9</u>	<u>110</u>	<u>118</u>	<u>98</u>	<u>71</u>	<u>90</u>	<u>70</u>	<u>88</u>	<u>70</u>	<u>84</u>	<u>68</u>	<u>73</u>	<u>71</u>	<u>21</u>	<u>32</u>	<u>37</u>	<u>39</u>	
<u>Downieville RS</u>	<u>16</u>	<u>39.6</u>	<u>2895</u>	<u>120.8</u>	<u>98</u>	<u>64</u>	<u>95</u>	<u>63</u>	<u>94</u>	<u>63</u>	<u>90</u>	<u>61</u>	<u>68</u>	<u>66</u>	<u>42</u>	<u>13</u>	<u>20</u>	<u>24</u>	
<u>Doyle</u>	<u>16</u>	<u>40</u>	<u>4390</u>	<u>120.1</u>	<u>96</u>	<u>63</u>	<u>93</u>	<u>62</u>	<u>92</u>	<u>61</u>	<u>88</u>	<u>59</u>	<u>66</u>	<u>64</u>	<u>42</u>	<u>0</u>	<u>5</u>	<u>12</u>	
<u>Dry Canyon Res</u>	<u>16</u>	<u>34.5</u>	<u>1455</u>	<u>118.5</u>	<u>105</u>	<u>71</u>	<u>100</u>	<u>69</u>	<u>99</u>	<u>69</u>	<u>96</u>	<u>68</u>	<u>74</u>	<u>72</u>	<u>32</u>	<u>24</u>	<u>29</u>	<u>32</u>	
<u>Duarte</u>	<u>9</u>	<u>34.1</u>	<u>500</u>	<u>118</u>	<u>100</u>	<u>69</u>	<u>96</u>	<u>68</u>	<u>94</u>	<u>68</u>	<u>90</u>	<u>67</u>	<u>73</u>	<u>71</u>	<u>33</u>	<u>31</u>	<u>36</u>	<u>38</u>	
<u>Dublin</u>	<u>12</u>	<u>37.7</u>	<u>200</u>	<u>121.5</u>	<u>99</u>	<u>69</u>	<u>93</u>	<u>67</u>	<u>91</u>	<u>67</u>	<u>86</u>	<u>65</u>	<u>70</u>	<u>68</u>	<u>35</u>	<u>24</u>	<u>29</u>	<u>32</u>	
<u>Dudleys</u>	<u>12</u>	<u>37.7</u>	<u>3000</u>	<u>120.1</u>	<u>97</u>	<u>65</u>	<u>94</u>	<u>64</u>	<u>93</u>	<u>64</u>	<u>90</u>	<u>62</u>	<u>68</u>	<u>66</u>	<u>44</u>	<u>10</u>	<u>17</u>	<u>22</u>	<u>4959</u>
<u>Duttons Landing</u>	<u>12</u>	<u>38.2</u>	<u>20</u>	<u>122.3</u>	<u>96</u>	<u>68</u>	<u>91</u>	<u>66</u>	<u>89</u>	<u>66</u>	<u>84</u>	<u>64</u>	<u>70</u>	<u>68</u>	<u>31</u>	<u>26</u>	<u>31</u>	<u>34</u>	
<u>Eagle Mtn</u>	<u>14</u>	<u>33.8</u>	<u>973</u>	<u>115.5</u>	<u>113</u>	<u>72</u>	<u>110</u>	<u>71</u>	<u>109</u>	<u>71</u>	<u>105</u>	<u>69</u>	<u>77</u>	<u>75</u>	<u>24</u>	<u>32</u>	<u>37</u>	<u>39</u>	<u>1138</u>
<u>Earlimart</u>	<u>13</u>	<u>35.8</u>	<u>283</u>	<u>119.3</u>	<u>106</u>	<u>71</u>	<u>102</u>	<u>70</u>	<u>101</u>	<u>70</u>	<u>98</u>	<u>69</u>	<u>74</u>	<u>72</u>	<u>36</u>	<u>23</u>	<u>26</u>	<u>29</u>	<u>1100</u>
<u>East Compton</u>	<u>8</u>	<u>34</u>	<u>71</u>	<u>118.2</u>	<u>97</u>	<u>69</u>	<u>90</u>	<u>68</u>	<u>88</u>	<u>68</u>	<u>83</u>	<u>67</u>	<u>72</u>	<u>70</u>	<u>21</u>	<u>33</u>	<u>37</u>	<u>39</u>	<u>436</u>
<u>East Hemet</u>	<u>10</u>	<u>33.7</u>	<u>1655</u>	<u>116.9</u>	<u>109</u>	<u>70</u>	<u>104</u>	<u>69</u>	<u>103</u>	<u>69</u>	<u>101</u>	<u>67</u>	<u>74</u>	<u>72</u>	<u>40</u>	<u>20</u>	<u>25</u>	<u>28</u>	
<u>East La Mirada</u>	<u>9</u>	<u>33.9</u>	<u>115</u>	<u>118.0</u>	<u>99</u>	<u>70</u>	<u>91</u>	<u>69</u>	<u>89</u>	<u>69</u>	<u>85</u>	<u>68</u>	<u>73</u>	<u>71</u>	<u>26</u>	<u>31</u>	<u>36</u>	<u>38</u>	
<u>East Los Angeles</u>	<u>9</u>	<u>34</u>	<u>250</u>	<u>118.3</u>	<u>99</u>	<u>69</u>	<u>92</u>	<u>68</u>	<u>90</u>	<u>68</u>	<u>86</u>	<u>67</u>	<u>72</u>	<u>70</u>	<u>21</u>	<u>38</u>	<u>41</u>	<u>43</u>	
<u>East Palo Alto</u>	<u>3</u>	<u>37.5</u>	<u>25</u>	<u>122.1</u>	<u>93</u>	<u>66</u>	<u>85</u>	<u>64</u>	<u>83</u>	<u>64</u>	<u>77</u>	<u>62</u>	<u>68</u>	<u>66</u>	<u>25</u>	<u>26</u>	<u>31</u>	<u>34</u>	<u>1103</u>
<u>East Park Res</u>	<u>11</u>	<u>39.4</u>	<u>1205</u>	<u>122.5</u>	<u>101</u>	<u>69</u>	<u>97</u>	<u>68</u>	<u>96</u>	<u>68</u>	<u>92</u>	<u>66</u>	<u>71</u>	<u>69</u>	<u>38</u>	<u>19</u>	<u>25</u>	<u>28</u>	<u>3455</u>
<u>East Pasadena</u>	<u>9</u>	<u>34.2</u>	<u>864</u>	<u>118.1</u>	<u>99</u>	<u>69</u>	<u>94</u>	<u>68</u>	<u>92</u>	<u>68</u>	<u>88</u>	<u>67</u>	<u>73</u>	<u>71</u>	<u>30</u>	<u>32</u>	<u>37</u>	<u>40</u>	<u>452</u>
<u>East Porterville</u>	<u>13</u>	<u>36.1</u>	<u>393</u>	<u>119.0</u>	<u>106</u>	<u>71</u>	<u>102</u>	<u>70</u>	<u>101</u>	<u>70</u>	<u>97</u>	<u>69</u>	<u>74</u>	<u>72</u>	<u>36</u>	<u>25</u>	<u>30</u>	<u>33</u>	<u>1129</u>
<u>East San Gabriel</u>	<u>9</u>	<u>34.1</u>	<u>450</u>	<u>118.1</u>	<u>99</u>	<u>70</u>	<u>94</u>	<u>69</u>	<u>92</u>	<u>69</u>	<u>88</u>	<u>68</u>	<u>73</u>	<u>71</u>	<u>30</u>	<u>30</u>	<u>35</u>	<u>37</u>	<u>431</u>
<u>Edwards AFB</u>	<u>14</u>	<u>34.9</u>	<u>2316</u>	<u>117.9</u>	<u>107</u>	<u>69</u>	<u>104</u>	<u>68</u>	<u>103</u>	<u>68</u>	<u>99</u>	<u>66</u>	<u>72</u>	<u>70</u>	<u>35</u>	<u>10</u>	<u>17</u>	<u>22</u>	<u>3123</u>
<u>El Cajon</u>	<u>10</u>	<u>32.7</u>	<u>525</u>	<u>117</u>	<u>96</u>	<u>70</u>	<u>91</u>	<u>69</u>	<u>90</u>	<u>69</u>	<u>87</u>	<u>67</u>	<u>72</u>	<u>70</u>	<u>30</u>	<u>29</u>	<u>34</u>	<u>36</u>	

City	Climate Zone	Latitude	Elevation (ft)	Longitude	Cooling								Heating						
					0.10%		0.50%		1.00%		2.00%		Design Wetbulb 0.1%	Design Wetbulb 0.5%	Outdoor Daily Range	Winter Median of Extremes	Design Drybulb (0.2%)	Design Drybulb (0.6%)	HDD*
					DB	MCWB	DB	MCWB	DB	MCWB	DB	MCWB							
El Capitan Dam	10	32.9	600	116.8	105	71	98	70	97	70	93	68	74	72	35	29	34	36	1533
El Centro	15	32.8	-30	115.6	115	74	111	73	110	73	107	73	81	79	34	26	35	38	1212
El Cerrito	3	37.8	70	122.3	91	66	84	64	81	64	75	62	68	65	17	30	35	38	
El Dorado Hills	12	38.6	673	121.1	103	70	100	69	98	69	94	67	72	71	36	24	30	34	
El Mirage	14	34.6	2910	117.6	105	69	101	68	100	68	97	66	72	70	31	9	16	21	
El Monte	9	34.1	271	118	101	71	97	70	95	70	91	68	73	71	30	31	36	39	
El Paso de Robles	4	35.6	721	120.7	102	65	95	65	94	65	90	65	69	67	44	16	20	23	1768
El Rio	6	34.3	50	119.2	95	69	88	68	86	68	82	66	71	69	20	30	34	37	
El Segundo	6	33.9	105	118.4	91	69	84	68	83	68	79	66	71	69	14	37	40	42	
El Sobrante	3	37.9	55	122.3	91	66	87	65	86	65	82	64	69	67	25	30	35	38	823
El Toro MCAS	8	33.7	380	117.7	96	69	89	69	87	69	82	68	73	71	26	34	38	41	1591
El Toro Station	8	33.7	380	117.7	96	69	89	69	87	69	82	68	73	71	26	34	38	41	560
Electra PH	12	38.3	715	120.7	106	70	102	69	101	69	98	68	73	71	41	23	28	31	2858
Elk Grove	12	38.4	50	121.4	104	71	100	69	98	69	94	68	73	71	35	29	34	36	1150
Elk Valley	1	42	1705	123.7	96	65	90	63	88	63	84	61	67	65	39	16	23	27	5404
Elsinore	10	33.7	1285	117.3	105	71	101	70	100	70	98	69	74	72	39	22	26	29	2128
Encinitas	7	33	50	117.3	87	68	83	67	81	67	77	65	70	68	10	35	39	41	
Encino	9	34.2	750	118.5	103	71	98	69	96	69	92	67	74	71	27	28	33	36	664
Enterprise	11	40.6	470	122.3	107	69	103	68	101	68	97	67	72	70	29	26	31	34	
Escondido	10	33.1	660	117.1	97	69	90	68	88	68	84	67	72	70	29	26	31	34	2005
Eureka	1	40.8	43	124.2	75	61	69	59	68	59	65	58	61	60	11	30	35	38	4679
Exeter	13	36.3	350	119.1	104	72	101	71	100	71	97	69	74	72	39	24	29	32	1236
Fair Oaks	12	38.7	50	121.3	104	70	100	69	98	69	94	69	72	71	36	23	29	33	
Fairfax	2	38	110	122.6	96	68	90	66	88	65	83	63	71	68	34	26	31	34	
Fairfield FS	12	38.3	38	122	103	69	98	68	96	68	91	66	73	71	34	24	30	33	2686

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					0.10%		0.50%		1.00%		2.00%		Design Wetbulb 0.1%	Design Wetbulb 0.5%	Outdoor Daily Range	Winter Median of Extremes	Design Drybulb (0.2%)	Design Drybulb (0.6%)	HDD*
					DB	MCWB	DB	MCWB	DB	MCWB	DB	MCWB							
Fairmont	14	34.7	3060	118.4	100	67	96	66	95	66	92	65	71	69	22	22	28	31	3330
Fairview	3	35.9	3519	118.5	97	67	94	66	93	66	90	64	70	68	43	11	18	23	
Fallbrook	10	33.6	660	117.3	94	68	89	67	88	67	85	66	71	69	29	26	31	34	2077
Farmersville	13	36.3	350	119.2	104	72	101	72	100	71	97	69	74	72	39	24	29	32	1236
Felton	3	37	100	122.1	94	68	88	66	86	66	81	64	69	67	28	27	32	35	1097
Ferndale	1	40.5	1445	124.3	76	57	66	56	65	56	62	54	59	57	12	28	33	35	
Fillmore	9	34.4	435	118.9	100	70	94	69	92	69	87	67	73	71	30	28	32	35	
Five Points	13	36.4	285	120.2	103	71	99	70	97	70	93	68	73	71	36	21	27	30	
Fleming Fish & Game	16	40.4	4000	120.3	96	62	93	61	92	61	88	59	66	64	40	-3	2	8	
Florence-Graham	8	34	175	118.3	98	69	90	68	88	68	84	67	72	70	19	35	40	43	
Florin	12	38.5	100	121.4	104	71	100	69	98	69	94	68	73	71	35	29	34	36	
Folsom Dam	12	38.7	350	121.2	104	70	101	69	99	69	95	67	72	71	36	25	31	35	
Fontana	10	34.1	1090	117.4	105	70	101	69	100	69	97	67	74	72	33	30	35	38	1530
Foothill Farms	12	38.6	90	121.3	104	71	100	70	98	70	94	68	73	71	36	24	30	34	
Forest Glen	16	40.4	2340	123.3	96	65	92	64	91	64	88	62	67	65	42	12	19	24	
Fort Baker	3	37.8	15	122.5	87	66	81	65	79	65	73	65	67	65	12	33	38	40	3080
Fort Bidwell	16	41.9	4498	120.1	93	60	90	59	89	59	85	57	64	62	38	-2	3	10	6381
Fort Bragg	1	39.5	80	123.8	75	60	67	59	66	59	62	58	62	61	15	29	34	37	4424
Fort Jones RS	16	41.6	2725	122.9	98	64	93	63	92	63	88	61	67	65	44	5	13	18	5590
Fort MacArthur	7	33.7	200	118.3	92	69	84	68	82	68	78	66	71	69	13	35	40	42	1819
Fort Ord	3	36.7	134	121.8	86	65	77	63	75	62	70	60	67	64	18	24	29	32	3818
Fort Ross	1	38.5	116	123.3	79	63	74	62	71	61	65	59	64	62	19	30	35	37	4127
Fortuna	1	40.6	100	124.2	75	61	69	59	68	59	65	58	61	60	11	30	35	38	2000
Foster City	3	37.5	20	122.7	92	67	84	65	82	65	76	63	68	66	22	29	34	36	
Fountain Valley	6	33.7	60	118	97	70	90	68	88	68	84	67	72	70	18	33	38	40	

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					0.10%		0.50%		1.00%		2.00%		Design Wetbulb 0.1%	Design Wetbulb 0.5%	Outdoor Daily Range	Winter Median of Extremes	Design Drybulb (0.2%)	Design Drybulb (0.6%)	HDD*
					DB	MCWB	DB	MCWB	DB	MCWB	DB	MCWB							
Freedom	3	37	1495	121.8	89	67	85	64	83	64	79	62	68	65	22	27	32	34	
Fremont	3	37.5	56	122	94	67	88	65	86	65	81	63	69	67	24	25	30	33	
Fresno AP	13	36.8	328	119.7	104	73	101	71	100	70	97	68	75	73	34	24	28	30	2650
Friant Gov Camp	13	37	410	119.7	106	72	103	70	102	70	100	68	74	72	40	23	28	31	2768
Fullerton	8	33.9	340	117.9	100	70	94	69	92	69	87	68	73	71	26	30	35	37	
Galt	12	38.2	40	121.3	101	70	97	68	95	68	91	67	72	70	38	23	28	31	1240
Garden Acres	12	38	20	121.3	103	71	98	69	97	69	93	67	73	71	35	24	28	30	1334
Garden Grove	8	33.6	85	117.9	98	70	91	68	89	68	84	67	72	70	23	31	36	38	
Gardena	8	33.9	40	118.3	92	69	85	68	84	68	80	66	71	69	18	32	37	39	
George AFB	14	34.6	2875	117.4	105	67	102	65	101	64	98	62	70	68	31	19	23	26	2887
Georgetown RS	12	38.9	3001	120.8	98	64	95	63	94	63	90	61	68	66	31	18	24	27	
Giant Forest	16	36.6	6412	118.8	84	56	81	55	80	55	77	53	60	58	26	5	13	18	
Gillespie Field	10	32.8	385	117.0	98	71	91	70	89	70	85	68	73	71	30	24	29	32	
Gilroy	4	37	194	121.6	101	70	93	68	91	67	86	65	72	69	25	23	28	31	
Glen Avon	10	34	827	117.5	105	70	101	69	99	69	95	67	74	72	35	28	33	35	
Glendale	9	34.2	563	118.3	101	70	96	68	94	68	90	67	73	71	28	30	35	37	
Glendora	9	34.1	822	117.9	102	69	98	68	96	68	92	67	73	71	35	30	35	37	
Glennville	16	35.7	3140	118.7	97	67	94	66	93	66	90	64	70	68	43	11	18	23	4423
Gold Rock Rch	15	32.9	485	114.8	113	73	110	72	109	72	106	70	79	77	28	31	36	38	
Golden Hills	16	35.1	4000	118.5	97	66	93	65	92	65	89	64	69	67	33	13	20	24	
Granada Hills	6	34.4	1032	118.5	100	70	95	68	93	68	89	66	73	70	37	28	31	34	664
Grand Terrace	10	34.1	1000	117.3	105	70	102	68	101	68	97	67	74	72	35	28	33	36	611
Grant Grove	13	36.7	6600	119	82	56	78	55	77	54	74	52	59	57	26	6	14	19	7044
Grass Valley	11	39.2	2400	121.1	99	67	96	65	95	65	91	63	69	67	29	19	25	28	
Graton	2	38.4	200	122.9	95	68	91	67	88	66	82	64	70	68	34	22	28	31	3409

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					DB	MCWB	DB	MCWB	DB	MCWB	DB	MCWB							
Greenacres	13	35.3	400	119.1	106	71	102	70	101	70	98	68	74	72	34	26	31	35	934
Greenfield	4	36.2	287	121.2	92	67	88	65	87	65	84	64	70	68	32	22	27	30	1020
Grossmont	7	32.7	530	117	96	69	89	68	88	68	84	66	71	69	23	31	36	38	
Grover City	5	35.1	100	120.6	93	69	86	64	84	64	80	62	67	65	18	30	34	37	
Guadalupe	5	35	85	120.6	92	66	86	64	84	64	79	62	67	65	18	28	32	35	1035
Hacienda Hts	9	34	300	118	100	69	96	68	94	68	90	67	73	71	28	31	36	38	
Haiwee	16	36.1	3825	118	102	65	99	64	98	64	95	62	68	66	27	15	22	26	3700
Half Moon Bay	3	37.5	60	122.4	83	64	76	62	74	61	69	59	65	63	15	32	37	39	3843
Hamilton AFB	2	38.1	3	122.5	95	69	88	67	86	67	81	65	73	70	28	27	30	32	3311
Hanford	13	36.3	242	119.7	102	71	99	70	98	70	94	68	73	71	37	22	28	31	2736
Happy Camp RS	16	41.8	1150	123.4	103	67	97	66	96	66	92	65	69	67	41	18	24	27	4263
Hat Creek PH 1	16	40.9	3015	121.6	99	65	96	64	95	64	91	62	68	66	48	2	7	17	5689
Hawaiian Gardens	8	33.8	75	118.1	97	70	91	69	89	69	84	67	72	70	23	32	37	39	
Hawthorne	8	33.9	70	118.4	92	69	85	68	84	68	80	66	71	69	16	37	40	42	
Hayfield Pumps	14	33.7	1370	115.6	112	71	108	70	107	70	104	68	77	75	31	24	29	32	1529
Hayward	3	37.7	530	122.1	92	66	86	65	85	64	81	62	68	66	24	26	31	34	2909
Healdsburg	2	38.6	102	122.9	102	69	95	68	94	68	90	66	71	69	37	26	31	34	2572
Hemet	10	33.7	1655	117	109	70	104	69	103	69	101	67	74	72	40	20	25	28	
Henshaw Dam	10	33.2	2700	116.8	99	68	94	67	93	67	90	66	71	69	38	15	22	26	3708
Hercules	3	38	15	122.3	91	66	87	65	86	65	82	64	69	67	25	30	35	38	823
Hermosa Beach	6	33.9	16	118.4	92	69	84	68	82	68	78	66	71	69	12	38	42	45	
Hesperia	14	34.4	3191	117.3	105	67	101	65	100	65	97	63	70	68	38	14	21	25	1654
Hetch Hetchy	16	38	3870	119.8	93	62	89	61	88	61	85	59	65	63	32	14	21	25	4816
Highland	10	34.1	1315	117.2	106	70	102	69	101	69	97	68	74	72	36	26	31	34	
Hillcrest Center	16	35.4	500		106	71	102	70	101	70	98	68	74	72	34	26	31	35	

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					0.10%		0.50%		1.00%		2.00%		Design Wetbulb 0.1%	Design Wetbulb 0.5%	Outdoor Daily Range	Winter Median of Extremes	Design Drybulb (0.2%)	Design Drybulb (0.6%)	HDD*
					DB	MCWB	DB	MCWB	DB	MCWB	DB	MCWB							
Hillsborough	3	37.6	352	122.3	90	66	82	65	80	65	74	64	68	66	23	30	35	37	
Hilt	16	42	2900	122.6	97	64	93	62	92	62	89	60	66	64	39	5	13	18	
Hollister	4	36.9	280	121.4	96	68	89	67	87	67	81	65	70	68	30	21	27	30	2725
Hollywood	9	34	384	118.4	96	70	89	69	87	69	83	67	72	70	20	36	41	44	
Home Gardens	10	33.9	678	117.5	104	70	100	69	98	69	92	67	74	72	35	26	31	34	
Hoopa	2	41	360	123.7	100	67	92	66	91	66	87	64	69	67	25	23	28	31	
Huntington Beach	6	33.7	40	117.8	91	69	83	67	81	67	76	66	71	69	14	34	38	41	
Huntington Lake	16	37.2	7020	119.2	80	55	77	54	76	53	73	51	58	56	25	3	11	16	7632
Huntington Park	8	34	175	118	98	70	90	69	88	69	84	67	72	70	20	38	42	45	
Idlewild	1	41.9	1250	124	103	68	96	66	95	66	92	65	69	67	40	18	24	27	
Idria	4	36.4	2650	120.7	97	66	92	65	91	64	87	62	68	66	27	24	29	32	3128
Idyllwild	1	33.7	5397	116.7	93	62	89	61	88	61	84	60	67	65	35	9	16	21	
Imperial AP	15	32.8	-59	115.6	114	74	110	73	109	73	106	72	81	79	31	26	31	34	1060
Imperial Beach	7	32.5	23	117.1	87	69	82	68	81	68	78	67	71	69	10	35	39	41	1839
Imperial CO	15	32.9	-64	115.6	112	73	108	72	107	72	104	71	80	78	31	29	34	36	976
Independence	16	36.8	3950	118.2	104	61	101	60	100	60	97	60	65	63	31	12	19	24	
Indio	15	33.7	11	116.3	115	75	112	75	111	75	107	74	81	79	30	24	29	32	1059
Inglewood	8	33.9	105	118	92	68	85	67	84	67	80	65	70	68	15	37	40	42	
Inyokern NAS	16	35.7	2440	117.8	110	71	106	68	105	68	102	66	75	71	37	15	22	26	2772
Ione	12	38.3	298	120.9	101	70	97	68	95	68	91	67	72	70	38	23	28	31	
Iron Mtn	11	34.1	922	115.1	116	75	112	74	111	74	108	73	80	78	26	29	34	36	1251
Irvine	8	33.7	50	118	96	69	88	68	86	68	82	67	72	70	27	33	37	40	
Isla Vista	6	34.5	40	119.9	90	69	83	67	81	67	77	65	70	68	20	33	38	40	
Jess Valley	16	41.3	5300	120.3	92	59	89	58	88	58	84	56	63	61	35	-7	-2	4	7045
John Wayne AP	6	33.6	115	117.9	98	70	91	68	89	68	84	67	72	70	26	33	37	39	1496

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					DB	MCWB	DB	MCWB	DB	MCWB	DB	MCWB							
Julian Wynola	14	33.1	3650	116.8	96	66	91	64	90	64	87	62	69	67	39	20	24	26	4049
Kentfield	2	38	120	122.6	97	66	91	65	89	65	84	63	70	68	35	27	32	35	3009
Kerman	13	36.6	216	120.1	105	73	101	71	100	70	97	68	75	73	34	24	28	30	1262
Kern River PH 1	13	35.5	970	118.8	106	72	103	71	102	71	99	69	75	73	26	30	35	37	1878
Kern River PH 3	16	35.8	2703	118.6	103	69	100	68	99	68	96	66	72	70	34	19	25	28	2891
Kettleman Stn	13	36.1	508	120.1	104	71	100	70	98	70	93	68	74	72	31	26	31	34	2180
King City	4	36.2	320	121.1	94	67	90	65	89	65	85	64	70	68	36	20	26	29	2639
Kingsburg	13	36.4	297	119.6	104	73	101	71	100	71	97	69	75	73	36	24	30	34	1300
Klamath	1	41.5	25	124.1	79	62	71	60	70	60	66	58	64	61	18	26	31	33	4509
Knights Ferry	12	37.8	315	120.6	103	70	99	68	98	68	94	67	73	71	37	19	25	28	
La Canada-Flintridge	16	34.2	1365	118	99	69	95	68	93	68	88	66	72	70	30	32	36	38	
La Crescenta-Montrose	9	34.2	1565	118	98	69	94	68	92	68	87	66	72	70	33	31	35	37	
La Habra	8	33.9	305	118	100	69	94	68	92	68	87	67	72	70	27	30	35	37	
La Habra Heights	9	34	400	118	100	69	94	68	92	68	87	67	72	70	27	30	35	37	
La Mesa	7	32.8	530	117	94	70	88	69	87	69	84	67	72	70	23	34	39	41	1567
La Mirada	9	33.9	115	118	99	70	91	69	89	69	85	68	73	71	26	31	36	38	
La Palma	8	33.9	75	118	98	69	92	68	90	68	85	67	72	70	25	31	35	38	
La Puente	9	34	320	118	101	71	97	70	95	70	91	69	74	72	28	31	36	38	
La Quinta	15	33.8	400	116.3	116	74	112	73	111	73	108	72	79	78	34	26	32	34	332
La Riviera	12	38.6	190	121.3	104	71	100	70	98	70	94	68	73	71	32	30	35	37	1025
La Verne	9	34.1	1235	118	101	69	97	68	95	68	91	67	73	71	34	29	34	36	
Ladera Heights	8	34.1	100	118.4	91	67	84	67	83	67	79	66	71	69	14	37	40	42	383
Lafayette	12	37.9	535	122.1	100	69	94	67	92	67	87	66	71	69	32	24	29	32	
Laguna Beach	6	33.5	35	117.8	91	69	83	68	81	68	76	66	71	69	18	30	33	36	2222

City	Climate Zone	Latitude	Elevation (ft)	Longitude	Cooling								Heating						
					0.10%		0.50%		1.00%		2.00%		Design Wetbulb 0.1%	Design Wetbulb 0.5%	Outdoor Daily Range	Winter Median of Extremes	Design Drybulb (0.2%)	Design Drybulb (0.6%)	HDD*
					DB	MCWB	DB	MCWB	DB	MCWB	DB	MCWB							
Laguna Niguel	6	33.6	500	117.7	95	67	87	66	85	65	81	63	71	67	22	33	37	40	
Lake Arrowhead	16	34.2	5205	117.2	90	62	86	61	85	61	81	59	66	64	26	13	20	24	5310
Lake Elsinore	10	33.7	1233	117.3	105	70	101	69	100	69	97	68	74	72	39	22	27	30	827
Lake Los Angeles	14	34.7	2300	117.8	106	68	102	67	101	67	98	66	72	70	35	12	17	20	1455
Lake Spaulding	16	39.3	5156	120.6	89	58	86	57	85	57	83	55	62	60	34	3	11	16	6447
Lakeland Village	10	33.6	1233	117.3	105	70	101	69	100	69	97	68	74	72	39	12	27	30	827
Lakeport	2	39	1347	122.9	97	67	93	66	92	65	88	63	69	67	41	20	26	29	3728
Lakeshore	16	40.9	1075	119.2	104	69	100	68	99	68	95	66	71	69	28	29	34	36	
Lakeside	10	32.8	690	117	95	69	90	68	89	68	86	66	72	70	20	26	31	34	
Lakewood	8	33.9	45	118	98	70	90	68	88	68	84	66	72	70	22	33	37	40	
Lamont	13	35.3	500	120	106	72	102	71	101	71	98	69	75	73	34	26	32	35	
Lancaster	14	34.7	2340	118.2	106	68	102	67	101	67	98	66	72	70	35	12	17	20	
Larksfield-Wikiup	2	38.5	170	122.8	99	69	96	68	95	68	92	66	71	69	35	24	27	29	1249
Larkspur	3	37.9	20	122.5	97	68	91	66	89	66	84	64	69	68	34	28	33	35	
Las Plumas	11	39.7	506	121.4	104	71	101	70	100	70	96	68	73	71	32	24	29	32	
Lathrop	12	37.8	22	121.3	103	71	98	69	97	69	93	67	73	71	35	24	28	30	1300
Lava Beds	16	41.7	4770	121.5	93	59	89	58	88	58	84	56	63	61	41	-1	4	11	
Lawndale	8	33.9	66	118	92	69	85	68	84	68	80	66	71	69	16	37	40	42	
Le Grand	12	37.2	255	120.3	101	70	96	68	95	68	91	66	72	70	38	23	28	31	2696
Lemon Grove	7	32.7	437	117.2	96	71	88	69	87	69	84	67	72	70	19	34	38	41	
Lemoncove	13	36.4	513	119	105	72	102	70	101	70	98	68	72	70	38	25	38	41	2513
Lemoore NAS	13	36.3	228	120	104	72	101	71	100	71	97	69	74	72	37	19	25	28	2960
Lennox	8	33.9	71	117.8	92	69	85	68	84	68	80	66	71	69	16	37	41	44	
Lincoln Village	12	38	12	121.3	101	70	96	68	95	68	91	67	72	70	37	24	28	30	1334
Linda	11	39	60	121.6	105	72	102	70	101	70	97	68	74	72	30	27	32	35	1160

City	Climate Zone	Latitude	Elevation (ft)	Longitude	Cooling								Heating						
					0.10%		0.50%		1.00%		2.00%		Design Wetbulb 0.1%	Design Wetbulb 0.5%	Outdoor Daily Range	Winter Median of Extremes	Design Drybulb (0.2%)	Design Drybulb (0.6%)	HDD*
					DB	MCWB	DB	MCWB	DB	MCWB	DB	MCWB							
Lindsay	13	36.2	395	119.1	105	72	101	71	100	71	97	69	74	72	40	24	29	32	2634
Little Panoche	13	36.8	677	120.7	100	68	94	67	92	67	86	66	71	69	33	23	28	31	
Live Oak	11	39.2	75	121.7	105	70	102	69	101	69	97	69	73	71	36	24	29	32	1160
Livermore	12	37.7	490	122	100	69	95	68	93	68	88	67	71	70	35	22	25	28	3012
Livingston	12	37.3	165	120.7	103	72	100	70	99	70	95	68	74	72	39	24	30	34	1244
Llano Shawnee	14	34.5	3820	117.8	104	68	99	67	98	67	95	65	71	69	31	21	27	31	
Lodgepole	16	36.6	6735	118.7	84	57	80	56	80	56	78	54	60	58	26	-4	1	7	
Lodi	12	38.1	40	121.3	101	70	97	68	95	68	91	67	72	70	38	23	28	31	2859
Loma Linda	10	34	1150	117.5	106	70	103	69	102	69	99	67	74	72	36	27	32	35	
Lomita	6	33.8	56	119	95	69	87	68	85	68	81	66	71	69	18	33	38	40	
Lompoc	5	34.9	95	120.5	84	63	77	62	76	62	72	60	65	63	18	26	31	34	2888
Long Beach	6	33.7	34	118.2	97	70	88	68	86	67	82	65	65	63	18	35	31	34	
Long Beach AP	8	33.8	25	118.2	99	71	90	69	88	68	84	66	73	71	21	33	38	41	1606
Loomis	11	38.8	408	121.2	107	71	103	70	102	70	98	69	74	72	39	21	27	30	
Los Alamitos NAS	8	33.8	30	118.1	98	71	89	69	87	69	83	68	73	71	23	32	37	39	1740
Los Altos	4	37.3	163	122	96	68	88	65	86	64	80	62	70	68	26	28	33	35	
Los Altos Hills	4	37.3	183	122.1	93	67	85	64	83	64	77	63	68	66	25	28	33	35	1103
Los Angeles AP	6	33.9	97	118.4	91	67	84	67	83	67	79	66	71	69	14	37	40	42	1819
Los Angeles CO	9	34	270	118.2	99	69	92	68	90	68	86	67	72	70	21	38	41	43	1245
Los Banos	12	37	120	120.9	100	70	96	68	94	68	88	67	72	70	42	22	28	31	2616
Los Banos Res	12	37	407	120.9	101	70	97	68	95	68	89	67	72	70	42	23	29	31	
Los Gatos	4	37.2	365	122	98	69	90	67	88	67	82	66	71	69	32	26	31	34	2741
Los Serranos	10	34.1	714	117.7	104	70	100	69	98	69	94	68	74	72	35	27	32	35	706
Lucas Vly-Marinwood	2	38.3	20	122.6	79	63	74	62	71	61	65	59	64	62	12	30	35	37	874
Lucerne Valley	14	34.5	2957	117	105	67	101	66	100	66	98	64	71	69	38	12	19	24	

City	Climate Zone	Latitude	Elevation (ft)	Longitude	Cooling								Heating						
					0.10%		0.50%		1.00%		2.00%		Design Wetbulb 0.1%	Design Wetbulb 0.5%	Outdoor Daily Range	Winter Median of Extremes	Design Drybulb (0.2%)	Design Drybulb (0.6%)	HDD*
					DB	MCWB	DB	MCWB	DB	MCWB	DB	MCWB							
<u>Lynwood</u>	<u>8</u>	<u>33.9</u>	<u>88</u>	<u>118</u>	<u>98</u>	<u>70</u>	<u>90</u>	<u>69</u>	<u>88</u>	<u>69</u>	<u>83</u>	<u>67</u>	<u>72</u>	<u>70</u>	<u>21</u>	<u>32</u>	<u>37</u>	<u>39</u>	
<u>Madera</u>	<u>13</u>	<u>37</u>	<u>268</u>	<u>120.1</u>	<u>105</u>	<u>72</u>	<u>101</u>	<u>70</u>	<u>100</u>	<u>70</u>	<u>96</u>	<u>68</u>	<u>74</u>	<u>72</u>	<u>40</u>	<u>24</u>	<u>29</u>	<u>32</u>	<u>2673</u>
<u>Madera Acres</u>	<u>13</u>	<u>36.9</u>	<u>275</u>	<u>120.1</u>	<u>105</u>	<u>72</u>	<u>101</u>	<u>70</u>	<u>100</u>	<u>70</u>	<u>96</u>	<u>68</u>	<u>74</u>	<u>72</u>	<u>40</u>	<u>24</u>	<u>29</u>	<u>32</u>	<u>1250</u>
<u>Manhattan Beach</u>	<u>6</u>	<u>33.9</u>	<u>120</u>	<u>118</u>	<u>91</u>	<u>69</u>	<u>84</u>	<u>68</u>	<u>83</u>	<u>68</u>	<u>79</u>	<u>66</u>	<u>71</u>	<u>69</u>	<u>12</u>	<u>38</u>	<u>42</u>	<u>45</u>	
<u>Manteca</u>	<u>12</u>	<u>37.8</u>	<u>34</u>	<u>121.2</u>	<u>102</u>	<u>70</u>	<u>97</u>	<u>68</u>	<u>95</u>	<u>68</u>	<u>91</u>	<u>67</u>	<u>72</u>	<u>70</u>	<u>37</u>	<u>24</u>	<u>29</u>	<u>32</u>	
<u>Manzanita Lake</u>	<u>11</u>	<u>40.5</u>	<u>5850</u>	<u>121.6</u>	<u>87</u>	<u>58</u>	<u>84</u>	<u>57</u>	<u>83</u>	<u>57</u>	<u>79</u>	<u>55</u>	<u>61</u>	<u>59</u>	<u>34</u>	<u>-3</u>	<u>2</u>	<u>8</u>	<u>7617</u>
<u>March AFB</u>	<u>10</u>	<u>33.9</u>	<u>1511</u>	<u>117.3</u>	<u>103</u>	<u>70</u>	<u>99</u>	<u>68</u>	<u>98</u>	<u>67</u>	<u>94</u>	<u>65</u>	<u>74</u>	<u>71</u>	<u>34</u>	<u>23</u>	<u>30</u>	<u>33</u>	<u>2089</u>
<u>Maricopa</u>	<u>13</u>	<u>35.1</u>	<u>675</u>	<u>119.4</u>	<u>106</u>	<u>71</u>	<u>102</u>	<u>70</u>	<u>101</u>	<u>70</u>	<u>98</u>	<u>68</u>	<u>74</u>	<u>72</u>	<u>29</u>	<u>25</u>	<u>30</u>	<u>33</u>	<u>2302</u>
<u>Marina</u>	<u>3</u>	<u>36.7</u>	<u>20</u>	<u>121.8</u>	<u>86</u>	<u>66</u>	<u>77</u>	<u>63</u>	<u>75</u>	<u>63</u>	<u>70</u>	<u>61</u>	<u>67</u>	<u>64</u>	<u>18</u>	<u>32</u>	<u>37</u>	<u>40</u>	
<u>Marina del Rey</u>	<u>6</u>	<u>34.1</u>	<u>40</u>	<u>118.5</u>	<u>91</u>	<u>69</u>	<u>84</u>	<u>68</u>	<u>83</u>	<u>68</u>	<u>79</u>	<u>66</u>	<u>71</u>	<u>69</u>	<u>12</u>	<u>38</u>	<u>42</u>	<u>45</u>	<u>383</u>
<u>Markley Cove</u>	<u>2</u>	<u>38.5</u>	<u>480</u>	<u>122.1</u>	<u>104</u>	<u>70</u>	<u>99</u>	<u>69</u>	<u>97</u>	<u>69</u>	<u>93</u>	<u>67</u>	<u>72</u>	<u>70</u>	<u>39</u>	<u>23</u>	<u>29</u>	<u>31</u>	
<u>Martinez FS</u>	<u>12</u>	<u>38</u>	<u>40</u>	<u>122.1</u>	<u>99</u>	<u>67</u>	<u>94</u>	<u>66</u>	<u>92</u>	<u>66</u>	<u>88</u>	<u>65</u>	<u>71</u>	<u>69</u>	<u>36</u>	<u>28</u>	<u>33</u>	<u>35</u>	
<u>Marysville</u>	<u>11</u>	<u>39.2</u>	<u>60</u>	<u>121.6</u>	<u>105</u>	<u>72</u>	<u>102</u>	<u>70</u>	<u>101</u>	<u>70</u>	<u>97</u>	<u>68</u>	<u>74</u>	<u>72</u>	<u>36</u>	<u>27</u>	<u>32</u>	<u>35</u>	<u>2552</u>
<u>Mather AFB</u>	<u>12</u>	<u>38.6</u>	<u>96</u>	<u>121.3</u>	<u>104</u>	<u>71</u>	<u>100</u>	<u>70</u>	<u>98</u>	<u>70</u>	<u>94</u>	<u>68</u>	<u>73</u>	<u>71</u>	<u>35</u>	<u>28</u>	<u>33</u>	<u>35</u>	
<u>Maywood</u>	<u>8</u>	<u>34</u>	<u>170</u>	<u>118</u>	<u>97</u>	<u>70</u>	<u>91</u>	<u>69</u>	<u>89</u>	<u>69</u>	<u>85</u>	<u>67</u>	<u>72</u>	<u>70</u>	<u>21</u>	<u>34</u>	<u>38</u>	<u>41</u>	
<u>McClellan AFB</u>	<u>12</u>	<u>38.7</u>	<u>86</u>	<u>121.4</u>	<u>105</u>	<u>71</u>	<u>102</u>	<u>70</u>	<u>100</u>	<u>70</u>	<u>96</u>	<u>68</u>	<u>74</u>	<u>71</u>	<u>35</u>	<u>23</u>	<u>28</u>	<u>21</u>	<u>2566</u>
<u>McCloud</u>	<u>16</u>	<u>41.3</u>	<u>3300</u>	<u>122.1</u>	<u>96</u>	<u>63</u>	<u>93</u>	<u>62</u>	<u>91</u>	<u>62</u>	<u>87</u>	<u>60</u>	<u>66</u>	<u>64</u>	<u>42</u>	<u>5</u>	<u>13</u>	<u>18</u>	<u>5990</u>
<u>McFarland</u>	<u>13</u>	<u>35.6</u>	<u>350</u>	<u>119.2</u>	<u>106</u>	<u>71</u>	<u>102</u>	<u>70</u>	<u>101</u>	<u>70</u>	<u>98</u>	<u>69</u>	<u>74</u>	<u>72</u>	<u>36</u>	<u>22</u>	<u>25</u>	<u>28</u>	<u>1162</u>
<u>McKinleyville</u>	<u>1</u>	<u>40.9</u>	<u>33</u>	<u>124.1</u>	<u>75</u>	<u>61</u>	<u>69</u>	<u>59</u>	<u>68</u>	<u>59</u>	<u>65</u>	<u>58</u>	<u>61</u>	<u>60</u>	<u>11</u>	<u>28</u>	<u>31</u>	<u>33</u>	<u>1995</u>
<u>Mecca FS</u>	<u>15</u>	<u>33.6</u>	<u>-180</u>	<u>116.1</u>	<u>115</u>	<u>75</u>	<u>111</u>	<u>75</u>	<u>110</u>	<u>75</u>	<u>107</u>	<u>74</u>	<u>81</u>	<u>79</u>	<u>30</u>	<u>24</u>	<u>29</u>	<u>32</u>	<u>1185</u>
<u>Mendota</u>	<u>13</u>	<u>36.7</u>	<u>169</u>	<u>120.4</u>	<u>105</u>	<u>73</u>	<u>101</u>	<u>71</u>	<u>100</u>	<u>70</u>	<u>97</u>	<u>68</u>	<u>75</u>	<u>73</u>	<u>34</u>	<u>24</u>	<u>28</u>	<u>30</u>	<u>1273</u>
<u>Menlo Park</u>	<u>3</u>	<u>37.4</u>	<u>65</u>	<u>122.3</u>	<u>94</u>	<u>67</u>	<u>86</u>	<u>65</u>	<u>84</u>	<u>65</u>	<u>78</u>	<u>63</u>	<u>69</u>	<u>67</u>	<u>25</u>	<u>27</u>	<u>32</u>	<u>34</u>	
<u>Mentone</u>	<u>10</u>	<u>34.1</u>	<u>1700</u>	<u>117.1</u>	<u>106</u>	<u>70</u>	<u>102</u>	<u>69</u>	<u>101</u>	<u>69</u>	<u>98</u>	<u>67</u>	<u>74</u>	<u>72</u>	<u>34</u>	<u>27</u>	<u>32</u>	<u>35</u>	<u>741</u>
<u>Merced AP</u>	<u>12</u>	<u>37.3</u>	<u>153</u>	<u>120.6</u>	<u>103</u>	<u>71</u>	<u>100</u>	<u>69</u>	<u>99</u>	<u>69</u>	<u>95</u>	<u>67</u>	<u>73</u>	<u>71</u>	<u>36</u>	<u>21</u>	<u>27</u>	<u>30</u>	<u>2653</u>
<u>Mill Creek</u>	<u>16</u>	<u>35.1</u>	<u>2940</u>	<u>117</u>	<u>102</u>	<u>67</u>	<u>97</u>	<u>66</u>	<u>96</u>	<u>66</u>	<u>94</u>	<u>65</u>	<u>70</u>	<u>68</u>	<u>28</u>	<u>28</u>	<u>33</u>	<u>36</u>	

City	Climate Zone	Latitude	Elevation (ft)	Longitude	Cooling								Heating						
					0.10%		0.50%		1.00%		2.00%		Design Wetbulb 0.1%	Design Wetbulb 0.5%	Outdoor Daily Range	Winter Median of Extremes	Design Drybulb (0.2%)	Design Drybulb (0.6%)	HDD*
					DB	MCWB	DB	MCWB	DB	MCWB	DB	MCWB							
Mill Valley	3	37.9	80	122.6	97	68	91	66	89	66	84	64	70	68	28	28	33	35	3400
Millbrae	3	37.6	10	122.4	90	66	82	63	80	63	74	61	67	65	24	30	35	37	
Milpitas	4	37.4	15	121.9	94	68	87	65	85	65	79	63	70	67	27	27	32	35	
Mineral	16	40.4	4911	121.6	90	60	87	59	86	59	82	57	63	61	38	2	7	14	7257
Mira Loma	10	34	700	117.5	105	70	101	69	99	68	95	66	74	72	34	25	33	36	600
Miramar AFS	7	32.9	477	117.1	97	69	91	68	90	68	86	67	72	70	22	32	36	38	1532
Miramonte	13	34.4	750	119.1	102	71	97	69	95	69	91	68	73	71	38	25	29	32	771
Mission Viejo	8	33.6	350	118	95	67	87	66	85	65	81	63	71	67	22	33	37	40	
Mitchell Caverns	14	34.9	4350	117.0	102	64	98	63	97	63	94	61	69	67	29	21	27	30	
Modesto	12	37.6	91	121	102	73	99	70	98	70	95	68	75	72	36	25	30	33	2671
Moffett Field NAS	4	37.4	39	122.1	89	68	84	66	82	66	78	64	70	68	23	30	34	36	2511
Mojave	14	35.1	2735	118.2	106	68	102	67	101	67	98	66	71	69	35	16	22	26	3012
Mono Lake	16	38	6450	119.2	91	58	88	57	87	57	84	55	62	60	32	4	12	17	6518
Monrovia	9	34.2	562	118.3	100	69	96	68	94	68	90	67	73	71	30	33	38	41	
Montague	16	41.8	2648	122.5	99	66	95	65	94	65	90	63	69	67	39	3	11	16	5474
Montclair	10	34	1220	117	104	69	100	68	98	68	94	66	73	71	35	28	33	35	
Montebello	9	34	205	118.1	98	69	93	68	91	68	86	67	72	70	24	33	37	39	
Monterey AP	3	36.6	245	121.9	86	65	77	62	75	62	70	61	66	63	20	30	35	38	3556
Monterey CO	3	36.6	345	121.9	87	65	78	62	76	62	71	61	66	63	20	32	37	40	3169
Monterey Park	9	34	380	118	99	69	94	68	92	68	87	67	72	70	23	30	35	37	
Monticello Dam	2	38.5	505	122.1	105	71	100	70	98	70	94	68	73	71	39	26	31	34	
Moraga	12	37.8	600	122.2	99	68	93	66	91	66	86	64	70	68	27	21	26	29	
Moreno Valley	10	33.9	1600	117.2	103	70	99	68	98	67	94	65	74	71	34	27	30	33	611
Morgan Hill	4	37.1	350	120	100	69	92	68	90	68	85	66	71	69	25	26	31	34	
Morro Bay FD	5	35.4	115	120.9	88	65	82	64	80	64	76	62	67	65	14	31	36	38	

City	Climate Zone	Latitude	Elevation (ft)	Longitude	Cooling								Heating						
					0.10%		0.50%		1.00%		2.00%		Design Wetbulb 0.1%	Design Wetbulb 0.5%	Outdoor Daily Range	Winter Median of Extremes	Design Drybulb (0.2%)	Design Drybulb (0.6%)	HDD*
					DB	MCWB	DB	MCWB	DB	MCWB	DB	MCWB							
Mount Baldy Notch	16	34.3	7735	117.6	80	58	76	57	75	56	71	54	61	59	32	4	10	14	
Mount Diablo	12	37.9	2100	121.9	101	68	96	66	93	66	87	65	68	59	28	27	32	35	4600
Mount Hamilton	4	37.3	4206	121.7	95	59	88	58	86	58	81	56	63	61	18	18	24	27	4724
Mount Hebron RS	16	41.8	4250	122	92	60	88	59	86	59	82	57	63	61	42	-10	-4	0	
Mount San Jacinto	16	33.8	8417	116.6	82	56	77	55	76	55	73	53	61	59	35	-1	4	11	
Mount Shasta	16	41.3	3535	122.3	93	62	89	61	88	61	84	59	65	63	34	8	15	20	5890
Mount Wilson	16	34.2	5709	118.1	90	63	85	61	83	60	79	58	66	64	21	15	22	26	4296
Mountain Pass	14	35.5	4730	115.5	100	65	96	64	95	64	92	63	68	66	29	11	18	23	
Mountain View	4	37.5	95	121.9	93	67	85	64	83	64	77	62	68	66	25	28	33	35	
Muscoy	10	34.2	1400	117.3	105	71	101	69	100	68	96	66	75	72	37	26	31	34	614
Nacimiento Dam	4	35.8	770	120.9	100	68	94	66	92	66	88	64	70	68	35	22	28	31	
Napa State Hospital	2	37.3	60	122.3	94	67	91	67	90	67	86	66	71	70	29	26	31	34	2749
National City	7	32.7	34	117	87	70	82	68	81	68	78	66	71	69	10	36	40	42	
Needles AP	15	34.8	913	114.6	117	73	114	72	113	72	110	71	77	75	26	27	32	35	1391
Nevada City	11	39.3	2600	121	97	66	94	64	92	64	88	63	68	66	41	14	21	25	4900
Newark	3	37.5	10	122	94	68	89	67	87	67	82	65	70	68	24	29	34	36	
Newhall Soledad	9	34.4	1243	118.6	104	70	100	68	99	68	95	67	73	71	42	27	33	36	
Newman	12	37.3	90	121.1	104	71	99	69	97	69	93	67	73	71	38	22	28	31	
Newport Beach	6	33.6	10	117.9	87	68	80	66	78	66	72	65	70	68	12	34	39	41	1952
Nipomo	5	35	330	120.5	90	66	83	64	82	63	78	61	67	65	23	25	31	33	1035
Norco	10	33.9	700	117	103	70	99	69	98	69	94	67	74	72	34	27	32	35	
North Auburn	11	38.9	1300	121.1	103	69	100	67	99	67	95	66	72	69	33	25	30	33	1518
North Fork RS	16	37.2	2630	119.5	98	66	95	65	94	64	92	62	69	67	36	15	22	26	
North Highlands	12	38.6	45	121.4	104	71	100	69	98	69	94	67	73	71	35	23	28	31	2566
North Hollywood	9	34.2	619	118.4	102	70	97	69	95	69	91	67	73	71	31	28	33	36	

City	Climate Zone	Latitude	Elevation (ft)	Longitude	Cooling								Heating						
					0.10%		0.50%		1.00%		2.00%		Design Wetbulb 0.1%	Design Wetbulb 0.5%	Outdoor Daily Range	Winter Median of Extremes	Design Drybulb (0.2%)	Design Drybulb (0.6%)	HDD*
					DB	MCWB	DB	MCWB	DB	MCWB	DB	MCWB							
<u>Northridge</u>	<u>9</u>	<u>34.2</u>	<u>875</u>	<u>118.5</u>	<u>101</u>	<u>70</u>	<u>96</u>	<u>69</u>	<u>94</u>	<u>69</u>	<u>90</u>	<u>67</u>	<u>73</u>	<u>71</u>	<u>36</u>	<u>30</u>	<u>35</u>	<u>38</u>	<u>650</u>
<u>Norwalk</u>	<u>8</u>	<u>33.9</u>	<u>97</u>	<u>118.1</u>	<u>99</u>	<u>69</u>	<u>90</u>	<u>68</u>	<u>88</u>	<u>68</u>	<u>84</u>	<u>67</u>	<u>72</u>	<u>70</u>	<u>26</u>	<u>31</u>	<u>35</u>	<u>37</u>	
<u>Novato</u>	<u>2</u>	<u>38.1</u>	<u>370</u>	<u>122.5</u>	<u>94</u>	<u>64</u>	<u>87</u>	<u>63</u>	<u>85</u>	<u>63</u>	<u>80</u>	<u>61</u>	<u>68</u>	<u>66</u>	<u>30</u>	<u>25</u>	<u>30</u>	<u>32</u>	
<u>Oakdale</u>	<u>12</u>	<u>37.8</u>	<u>215</u>	<u>120.9</u>	<u>102</u>	<u>71</u>	<u>99</u>	<u>69</u>	<u>97</u>	<u>69</u>	<u>93</u>	<u>67</u>	<u>73</u>	<u>71</u>	<u>37</u>	<u>22</u>	<u>28</u>	<u>32</u>	
<u>Oakland AP</u>	<u>3</u>	<u>37.7</u>	<u>6</u>	<u>122.2</u>	<u>91</u>	<u>66</u>	<u>84</u>	<u>64</u>	<u>82</u>	<u>64</u>	<u>77</u>	<u>62</u>	<u>67</u>	<u>65</u>	<u>20</u>	<u>32</u>	<u>34</u>	<u>37</u>	<u>2909</u>
<u>Oakland Museum</u>	<u>3</u>	<u>37.8</u>	<u>30</u>	<u>122.2</u>	<u>96</u>	<u>68</u>	<u>89</u>	<u>66</u>	<u>87</u>	<u>65</u>	<u>82</u>	<u>63</u>	<u>69</u>	<u>67</u>	<u>20</u>	<u>31</u>	<u>33</u>	<u>36</u>	
<u>Oakley</u>	<u>12</u>	<u>38</u>	<u>20</u>	<u>121.7</u>	<u>102</u>	<u>70</u>	<u>97</u>	<u>68</u>	<u>95</u>	<u>68</u>	<u>91</u>	<u>66</u>	<u>70</u>	<u>69</u>	<u>34</u>	<u>22</u>	<u>28</u>	<u>31</u>	
<u>Oceano</u>	<u>5</u>	<u>35.1</u>	<u>20</u>	<u>120.6</u>	<u>93</u>	<u>69</u>	<u>86</u>	<u>64</u>	<u>84</u>	<u>64</u>	<u>80</u>	<u>62</u>	<u>67</u>	<u>65</u>	<u>18</u>	<u>30</u>	<u>34</u>	<u>37</u>	<u>795</u>
<u>Oceanside</u>	<u>7</u>	<u>33.2</u>	<u>10</u>	<u>117.4</u>	<u>84</u>	<u>69</u>	<u>80</u>	<u>67</u>	<u>78</u>	<u>67</u>	<u>74</u>	<u>65</u>	<u>70</u>	<u>68</u>	<u>10</u>	<u>33</u>	<u>37</u>	<u>39</u>	
<u>Oildale</u>	<u>13</u>	<u>35.5</u>	<u>450</u>	<u>119</u>	<u>106</u>	<u>71</u>	<u>102</u>	<u>70</u>	<u>101</u>	<u>70</u>	<u>98</u>	<u>68</u>	<u>74</u>	<u>72</u>	<u>34</u>	<u>26</u>	<u>31</u>	<u>35</u>	
<u>Ojai</u>	<u>16</u>	<u>34.5</u>	<u>750</u>	<u>119.3</u>	<u>102</u>	<u>71</u>	<u>97</u>	<u>69</u>	<u>95</u>	<u>69</u>	<u>91</u>	<u>68</u>	<u>73</u>	<u>71</u>	<u>38</u>	<u>25</u>	<u>29</u>	<u>32</u>	<u>2145</u>
<u>Olivehurst</u>	<u>11</u>	<u>39</u>	<u>64</u>	<u>121.6</u>	<u>105</u>	<u>72</u>	<u>102</u>	<u>70</u>	<u>101</u>	<u>70</u>	<u>97</u>	<u>68</u>	<u>74</u>	<u>72</u>	<u>36</u>	<u>27</u>	<u>32</u>	<u>35</u>	<u>1160</u>
<u>Ontario AP</u>	<u>10</u>	<u>34</u>	<u>934</u>	<u>117</u>	<u>105</u>	<u>70</u>	<u>101</u>	<u>69</u>	<u>99</u>	<u>68</u>	<u>95</u>	<u>66</u>	<u>74</u>	<u>72</u>	<u>34</u>	<u>26</u>	<u>33</u>	<u>36</u>	<u>1710</u>
<u>Opal Cliffs</u>	<u>3</u>	<u>37</u>	<u>125</u>	<u>122</u>	<u>94</u>	<u>68</u>	<u>88</u>	<u>66</u>	<u>86</u>	<u>66</u>	<u>81</u>	<u>64</u>	<u>69</u>	<u>67</u>	<u>28</u>	<u>27</u>	<u>32</u>	<u>35</u>	<u>1097</u>
<u>Orange</u>	<u>8</u>	<u>33.6</u>	<u>194</u>	<u>118</u>	<u>99</u>	<u>70</u>	<u>92</u>	<u>68</u>	<u>90</u>	<u>68</u>	<u>85</u>	<u>67</u>	<u>72</u>	<u>70</u>	<u>27</u>	<u>33</u>	<u>37</u>	<u>40</u>	
<u>Orange Cove</u>	<u>13</u>	<u>36.6</u>	<u>431</u>	<u>119.3</u>	<u>104</u>	<u>71</u>	<u>100</u>	<u>69</u>	<u>99</u>	<u>69</u>	<u>97</u>	<u>68</u>	<u>73</u>	<u>71</u>	<u>38</u>	<u>25</u>	<u>30</u>	<u>33</u>	<u>2684</u>
<u>Orangevale</u>	<u>12</u>	<u>38.7</u>	<u>140</u>	<u>121.2</u>	<u>105</u>	<u>72</u>	<u>102</u>	<u>70</u>	<u>100</u>	<u>70</u>	<u>96</u>	<u>68</u>	<u>74</u>	<u>71</u>	<u>36</u>	<u>24</u>	<u>30</u>	<u>34</u>	
<u>Orick Prairie Creek</u>	<u>1</u>	<u>41.4</u>	<u>161</u>	<u>124</u>	<u>80</u>	<u>61</u>	<u>75</u>	<u>60</u>	<u>74</u>	<u>60</u>	<u>70</u>	<u>59</u>	<u>63</u>	<u>61</u>	<u>23</u>	<u>25</u>	<u>30</u>	<u>33</u>	<u>4816</u>
<u>Orinda</u>	<u>12</u>	<u>37.9</u>	<u>550</u>	<u>122.2</u>	<u>99</u>	<u>68</u>	<u>93</u>	<u>66</u>	<u>91</u>	<u>66</u>	<u>86</u>	<u>64</u>	<u>70</u>	<u>68</u>	<u>32</u>	<u>21</u>	<u>26</u>	<u>29</u>	
<u>Orland</u>	<u>11</u>	<u>39.8</u>	<u>254</u>	<u>122.2</u>	<u>105</u>	<u>71</u>	<u>102</u>	<u>70</u>	<u>101</u>	<u>70</u>	<u>97</u>	<u>68</u>	<u>73</u>	<u>71</u>	<u>36</u>	<u>22</u>	<u>28</u>	<u>31</u>	<u>2824</u>
<u>Orleans</u>	<u>2</u>	<u>41.3</u>	<u>403</u>	<u>123.5</u>	<u>104</u>	<u>70</u>	<u>97</u>	<u>68</u>	<u>95</u>	<u>68</u>	<u>91</u>	<u>66</u>	<u>71</u>	<u>69</u>	<u>42</u>	<u>21</u>	<u>27</u>	<u>30</u>	<u>3628</u>
<u>Orosi</u>	<u>13</u>	<u>36.5</u>	<u>400</u>	<u>119.3</u>	<u>104</u>	<u>73</u>	<u>101</u>	<u>70</u>	<u>100</u>	<u>70</u>	<u>96</u>	<u>69</u>	<u>75</u>	<u>73</u>	<u>36</u>	<u>24</u>	<u>30</u>	<u>34</u>	<u>1130</u>
<u>Oroville East</u>	<u>11</u>	<u>39.5</u>	<u>171</u>	<u>121.6</u>	<u>106</u>	<u>71</u>	<u>104</u>	<u>70</u>	<u>102</u>	<u>70</u>	<u>98</u>	<u>69</u>	<u>74</u>	<u>72</u>	<u>37</u>	<u>25</u>	<u>30</u>	<u>33</u>	<u>1385</u>
<u>Oroville RS</u>	<u>11</u>	<u>39.5</u>	<u>300</u>	<u>121.6</u>	<u>106</u>	<u>71</u>	<u>104</u>	<u>70</u>	<u>102</u>	<u>70</u>	<u>98</u>	<u>69</u>	<u>74</u>	<u>72</u>	<u>37</u>	<u>25</u>	<u>30</u>	<u>33</u>	
<u>Otay-Castle Pk</u>	<u>7</u>	<u>32.6</u>	<u>500</u>	<u>117</u>	<u>87</u>	<u>68</u>	<u>81</u>	<u>66</u>	<u>79</u>	<u>65</u>	<u>74</u>	<u>63</u>	<u>69</u>	<u>67</u>	<u>10</u>	<u>33</u>	<u>38</u>	<u>40</u>	

City	Climate Zone	Latitude	Elevation (ft)	Longitude	Cooling								Heating						
					0.10%		0.50%		1.00%		2.00%		Design Wetbulb 0.1%	Design Wetbulb 0.5%	Outdoor Daily Range	Winter Median of Extremes	Design Drybulb (0.2%)	Design Drybulb (0.6%)	HDD*
					DB	MCWB	DB	MCWB	DB	MCWB	DB	MCWB							
Oxnard AFB	6	34.2	49	119.2	94	69	86	68	84	68	79	67	71	69	21	30	34	37	2068
Pacific Grove	3	36.7	114	122	87	66	78	63	76	63	71	61	67	64	19	31	35	37	
Pacifica	3	37.6	13	122	87	65	79	62	77	62	71	60	66	64	16	31	35	37	
Pacoima	9	34.3	895	118.4	104	71	99	70	98	70	94	68	74	72	35	29	34	37	664
Palermo	11	39.4	154	121.5	106	71	104	70	102	70	98	69	74	72	37	25	30	33	1170
Palm Desert	15	33.7	200	116.5	116	74	112	73	111	73	108	72	79	78	34	26	32	34	
Palm Desert Country	15	33.7	243	116.3	116	74	112	73	111	73	108	72	79	78	34	26	32	34	374
Palm Springs	15	33.8	411	116.5	117	74	113	73	112	73	109	72	79	78	35	26	31	34	1109
Palmdale AP	14	34.6	2517	118.1	107	67	103	67	102	66	98	64	71	69	33	12	20	24	2929
Palmdale CO	14	34.6	2596	118.1	106	67	102	67	101	66	97	64	71	69	35	13	21	25	2908
Palo Alto	4	37.5	25	122.1	93	66	85	64	83	64	77	62	68	66	25	26	31	34	2891
Palomar Obsy	14	33.4	5545	116.9	90	62	85	61	84	61	80	59	66	64	22	16	20	23	4141
Palos Verdes	6	33.8	216	119	92	69	84	68	82	68	78	66	71	69	14	38	43	46	
Panorama City	9	34.2	801	118.5	103	71	98	69	96	69	92	67	74	71	32	28	33	36	664
Paradise	11	39.8	1750	121.6	102	69	99	67	98	67	94	66	71	69	34	25	30	33	
Paramount	8	33.9	70	117	98	70	90	69	88	69	84	67	72	70	22	32	37	40	
Parker Res	15	34.3	738	114.2	115	74	112	73	111	73	108	72	79	77	26	32	37	40	1223
Parkway-South Sacramento	12	38.5	17	121.4	104	71	100	70	98	70	94	68	73	71	32	30	35	37	1150
Parlier	13	36.6	320	119.5	104	73	101	71	100	70	97	68	75	73	38	24	30	34	1262
Pasadena	9	34.2	864	118.2	99	69	94	68	92	68	88	67	73	71	30	32	37	40	1551
Paso Robles AP	4	35.7	815	120.7	104	66	97	66	96	66	92	65	70	68	40	19	23	26	2973
Paso Robles CO	4	35.6	700	120.7	102	65	95	65	94	65	90	65	69	67	44	16	20	23	2885
Patterson	12	37.4	97	121.1	101	72	96	70	94	69	90	67	74	72	36	24	30	34	1240
Pedley	10	34	718	117.5	105	70	101	69	99	68	95	66	74	72	34	26	33	36	600

City	Climate Zone	Latitude	Elevation (ft)	Longitude	Cooling								Heating						
					0.10%		0.50%		1.00%		2.00%		Design Wetbulb 0.1%	Design Wetbulb 0.5%	Outdoor Daily Range	Winter Median of Extremes	Design Drybulb (0.2%)	Design Drybulb (0.6%)	HDD*
					DB	MCWB	DB	MCWB	DB	MCWB	DB	MCWB							
Pendleton MCB	7	33.3	63	117.3	92	68	87	67	85	67	81	66	71	69	22	34	39	41	1532
Pendleton MCB Coast	7	33.2	24	117.4	84	69	80	67	79	67	75	65	70	68	10	39	44	46	1782
Perris	10	33.8	1470	117.2	105	70	101	69	100	69	97	68	74	72	39	22	27	30	
Petaluma FS 2	2	38.2	16	122.6	98	69	92	67	90	67	85	66	72	69	31	24	29	32	2959
Pico Rivera	9	34	180	118	98	70	91	69	89	69	85	67	72	70	24	31	35	38	
Piedmont	3	37.8	325	122	96	68	89	66	87	65	82	63	70	68	23	31	33	36	
Pinnacles NM	4	36.5	1307	121.2	98	68	94	67	93	66	89	64	70	68	45	20	26	29	2956
Pinole	3	38	10	122.3	91	66	87	65	86	65	82	64	69	67	25	30	35	38	
Pismo Beach	5	35.1	80	120.6	92	66	85	64	84	64	80	62	67	65	16	30	34	37	2756
Pittsburg	12	38	50	121.8	102	70	97	68	95	68	90	67	72	70	34	26	32	35	
Placentia	8	33.9	323	118	101	69	93	68	91	68	87	67	73	71	28	30	34	37	
Placerville	12	38.7	1890	120.8	101	67	98	66	97	66	93	65	70	68	42	20	26	29	4086
Placerville IFG	12	38.7	2755	120.8	100	66	97	65	96	65	92	64	69	67	42	23	28	31	
Platina	11	40.4	2260	122.9	96	65	92	64	91	63	87	61	67	65	36	13	20	24	
Pleasant Hill	12	37.9	102	122	96	68	93	67	92	67	88	65	70	68	34	25	30	33	
Pleasanton	12	37.6	350	121.8	97	68	94	67	93	67	89	65	70	68	35	24	29	32	
Point Arena	1	38.9	100	123.7	76	62	72	60	71	60	67	58	63	61	19	29	32	34	4747
Point Arquette	5	34.6	76	120.7	75	64	71	63	69	62	65	59	65	63	17	29	32	35	3826
Point Mugu	6	34.1	14	119.1	88	68	81	67	79	67	75	66	70	68	15	33	37	39	2328
Point Piedras Blancas	5	35.7	59	121.3	73	60	67	59	65	59	61	57	62	60	10	36	41	43	3841
Pomona Cal Poly	9	34.1	740	117.8	102	70	98	69	97	69	93	67	74	72	36	27	32	35	1971
Port Chicago ND	12	38	50	122	98	69	94	68	92	68	88	66	71	69	34	28	33	36	
Port Hueneme	6	34.2	13	119	88	68	81	67	79	67	75	66	70	68	15	33	37	39	2334
Porterville	13	36.1	393	119	106	71	102	70	101	70	97	69	74	72	36	25	30	33	2456
Portola	16	39.8	4850	120.5	92	63	89	61	88	61	84	59	65	63	48	-9	-3	1	7111

City	Climate Zone	Latitude	Elevation (ft)	Longitude	Cooling								Heating						
					0.10%		0.50%		1.00%		2.00%		Design Wetbulb 0.1%	Design Wetbulb 0.5%	Outdoor Daily Range	Winter Median of Extremes	Design Drybulb (0.2%)	Design Drybulb (0.6%)	HDD*
					DB	MCWB	DB	MCWB	DB	MCWB	DB	MCWB							
Posey 3 E	16	35.8	4960	119	89	62	86	61	85	61	82	59	65	63	26	9	16	21	
Potter Valley PH	2	39.4	1015	123.1	101	68	96	67	94	67	89	65	70	68	40	20	26	29	3276
Poway Valley	10	33	500	117	100	70	94	69	93	69	89	68	73	71	26	29	33	35	
Priest Valley	4	36.2	2300	120.7	97	66	93	65	92	65	88	63	69	67	34	13	20	24	4144
Prunedale	3	36.6	260	121.7	86	66	83	65	82	64	79	62	68	66	20	26	31	34	1100
Quartz Hill	14	34.6	2428	118.2	106	68	102	67	101	67	98	66	72	70	35	12	17	20	1455
Quincy	16	39.9	3409	120.9	101	64	98	63	97	63	93	62	68	66	45	1	6	13	5763
Ramona Spaulding	10	33.1	1480	116.8	103	70	97	69	96	69	92	68	73	71	40	22	28	31	
Rancho Bernardo	10	33	500	117.1	96	69	91	68	89	68	85	67	72	70	26	29	34	36	
Rancho Cordova	12	38.6	190	121.3	104	72	100	69	98	69	94	68	74	71	35	26	31	33	
Rancho Mirage	15	33.8	248	116.4	117	74	113	73	112	73	109	72	79	78	33	26	31	34	374
Rancho Palos Verdes	6	33.7	216	118.2	92	69	84	68	82	68	78	66	71	69	14	38	43	46	
Rancho San Diego	10	32.8	300	117.0	94	69	86	68	85	68	82	66	71	69	30	34	38	41	404
Rancho Santa Margarita	8	33.6	116	117.6	95	67	87	66	85	65	81	63	71	67	22	33	37	40	496
Randsburg	14	35.3	3570	117.7	105	67	102	66	101	66	97	65	70	68	30	19	25	28	2922
Red Bluff AP	11	40.2	342	122.3	107	70	104	69	102	68	98	66	73	71	31	24	29	31	2688
Redding FS 4	11	40.6	470	122.4	107	69	103	68	101	68	97	67	72	70	30	26	31	34	2544
Redlands	10	34.1	1318	117.2	106	70	102	69	101	69	98	67	74	72	34	27	32	35	1993
Redondo Beach	6	33.8	45	118.3	92	69	84	68	82	68	78	66	71	69	12	37	42	44	
Redwood City	3	37.5	31	122.2	90	67	86	66	85	66	81	64	69	67	28	28	33	35	2599
Reedley	13	36.6	344	119.7	104	71	101	70	100	70	96	68	74	72	40	24	30	34	
Reseda	9	34.2	736	118.5	103	71	98	69	96	69	92	67	74	71	32	28	33	36	664
Rialto	10	34.1	1254	117	105	70	101	69	100	68	96	66	74	72	35	28	33	35	
Richardson Grove	2	40	500	123.8	96	67	92	66	91	66	87	64	69	67	28	25	30	33	

City	Climate Zone	Latitude	Elevation (ft)	Longitude	Cooling								Heating						
					0.10%		0.50%		1.00%		2.00%		Design Wetbulb 0.1%	Design Wetbulb 0.5%	Outdoor Daily Range	Winter Median of Extremes	Design Drybulb (0.2%)	Design Drybulb (0.6%)	HDD*
					DB	MCWB	DB	MCWB	DB	MCWB	DB	MCWB							
Richmond	3	37.9	55	121.6	88	65	84	64	82	64	77	62	67	65	17	31	36	38	2684
Ridgecrest	14	35.6	2340	117.8	110	70	106	68	105	68	102	66	75	71	35	15	22	26	
Rio Del Mar	3	37	50	121.9	94	67	88	66	87	65	83	63	69	67	30	27	32	35	1097
Rio Linda	12	38.6	86	121.5	104	72	100	70	98	70	94	68	74	71	32	28	33	35	1290
Ripon	12	37.7	61	121.1	102	70	97	68	95	68	91	67	72	70	37	23	30	33	1240
Riverbank	12	37.7	133	120.9	102	73	99	70	98	70	95	68	75	72	36	25	30	33	1240
Riverside Exp Sta	10	34	986	117.4	106	71	102	69	101	69	97	67	75	72	36	29	34	36	
Riverside FS 3	10	34	840	117.4	104	70	100	69	99	68	95	65	74	72	37	27	32	35	1818
Rocklin	11	38.8	239	121.2	108	72	104	70	103	70	99	69	74	72	39	20	26	29	3143
Rodeo	3	38.1	15	122.3	93	67	90	66	88	66	84	64	70	68	23	28	33	36	823
Rohnert Park	2	38.4	106	122.6	99	69	96	68	95	68	92	66	71	69	33	24	27	29	
Rolling Hills	6	33.6	216	119	92	69	84	68	82	68	78	66	71	69	15	38	43	46	
Rosamond	14	34.8	2326	118.2	106	68	102	67	101	67	98	66	71	69	35	16	22	26	1455
Roseland	2	38.4	167	122.7	99	69	96	68	95	68	92	66	71	69	35	24	27	29	1249
Rosemead	9	34	275	118	98	70	90	69	88	69	84	67	72	70	27	30	35	37	
Rosemont	12	38.3	190	121.4	104	71	100	70	98	70	94	68	73	71	32	30	35	37	1025
Roseville	11	38.7	160	121.2	105	71	102	70	100	70	96	68	74	71	36	24	30	34	
Rossmoor	8	33.8	20	118.1	92	67	85	64	83	64	79	62	71	69	19	32	37	39	
Rowland Hts	9	33.9	540	118	99	70	93	69	91	69	86	68	73	71	27	29	34	36	
Rubidoux	10	34	792	117	106	71	102	70	101	70	97	68	75	73	36	27	32	35	
Sacramento AP	12	38.5	17	121.5	104	72	100	70	98	70	94	68	74	71	35	26	31	33	2843
Sacramento CO	12	38.6	84	121.5	104	71	100	70	98	70	94	68	73	71	32	30	35	37	
Saint Helena	2	38.5	225	122.5	102	70	98	69	97	69	93	67	72	70	40	22	28	31	2878
Saint Mary's College	12	37.8	623	122.1	98	69	93	68	91	68	86	66	71	69	28	21	27	30	3543
Salinas 3 E	3	36.7	85	121.6	86	66	83	65	82	64	79	62	68	66	20	26	31	34	

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					0.10%		0.50%		1.00%		2.00%		Design Wetbulb 0.1%	Design Wetbulb 0.5%	Outdoor Daily Range	Winter Median of Extremes	Design Drybulb (0.2%)	Design Drybulb (0.6%)	HDD*
					DB	MCWB	DB	MCWB	DB	MCWB	DB	MCWB							
Salinas AP	3	36.7	69	121.6	85	67	82	65	81	64	78	62	69	66	20	28	33	35	2959
Salt Springs PH	16	38.5	3700	120.2	95	62	92	61	91	61	87	59	66	64	27	19	25	28	3857
Salyer RS	16	40.9	623	123.6	102	69	95	67	93	66	87	64	70	68	33	22	28	31	
San Anselmo	2	38	50	122	95	67	89	66	87	66	82	65	70	68	32	26	31	33	
San Antonio Canyon	10	34.2	2394	117.7	100	68	96	67	94	67	90	65	72	70	33	29	35	39	
San Antonio Mission	4	36	1060	117.7	99	69	94	68	92	68	88	67	71	69	28	19	25	28	
San Bernardino	10	34.1	1125	117.3	106	70	102	69	101	69	98	68	75	72	39	27	31	33	1777
San Bruno	3	37.7	20	122.4	86	66	80	64	78	64	73	62	67	65	23	30	35	38	3042
San Carlos	3	37.5	26	122.3	92	67	88	65	86	65	82	63	68	66	28	28	33	35	
San Clemente	6	33.4	208	118.6	91	68	85	67	84	67	80	66	71	69	12	31	35	37	
San Diego AP	7	32.7	13	117.2	88	70	83	69	82	69	78	68	72	70	13	38	42	44	1507
San Dimas	9	34	955	118.4	102	70	98	69	96	69	92	67	74	72	35	30	35	37	
San Fernando	9	34.3	977	118.5	104	71	99	70	98	70	94	68	74	72	37	30	35	37	1800
San Francisco AP	3	37.6	8	122.4	89	66	83	64	80	63	74	61	67	64	20	31	35	38	3042
San Francisco CO	3	37.8	52	122.4	84	65	79	63	77	62	71	60	66	63	14	38	41	44	3080
San Gabriel FD	9	34.1	450	118.1	99	70	94	69	92	69	88	68	73	71	30	30	35	37	1532
San Gregorio 2 SE	3	37.3	275	122.4	87	66	81	63	79	63	74	61	68	65	30	27	32	35	
San Jacinto	10	33.8	1535	117	110	70	105	69	104	69	102	68	75	73	41	20	26	29	2376
San Jose	4	37.4	67	121.9	94	68	86	66	84	66	78	64	70	68	26	29	34	36	2438
San Leandro	3	37.7	45	122.2	89	67	83	64	81	64	76	62	69	66	22	28	33	35	
San Lorenzo	3	37.7	45	122.1	89	67	83	64	81	64	76	62	69	66	23	28	33	36	
San Luis Dam	12	37.1	277	121.1	97	68	91	66	90	66	86	64	70	68	32	25	30	33	
San Luis Obispo	5	35.3	320	120.7	94	63	87	63	85	63	81	62	67	65	26	30	33	35	2498
San Marcos	10	33.1	567	117.2	97	69	98	68	94	68	84	67	72	70	29	26	31	34	662
San Marino	9	34.2	300	118.1	100	69	95	68	93	68	88	66	73	71	28	30	35	37	

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					0.10%		0.50%		1.00%		2.00%		Design Wetbulb 0.1%	Design Wetbulb 0.5%	Outdoor Daily Range	Winter Median of Extremes	Design Drybulb (0.2%)	Design Drybulb (0.6%)	HDD*
					DB	MCWB	DB	MCWB	DB	MCWB	DB	MCWB							
San Mateo	3	37.5	21	122.3	92	67	84	65	82	65	76	63	68	66	24	31	36	38	2655
San Nicholas Island	6	33.2	504	119.5	85	66	78	65	76	65	70	64	69	67	11	39	43	45	2454
San Pablo	3	37.6	30	122.3	90	65	84	63	82	63	77	61	69	66	17	29	34	37	
San Pedro	6	33.7	10	118.3	92	69	84	68	82	68	78	66	72	70	13	35	31	34	1819
San Rafael	2	38	40	122.6	96	67	90	65	88	65	83	63	71	68	29	30	35	37	2440
San Ramon	12	37.7	360	122	99	69	93	67	91	67	86	65	70	68	35	24	29	32	1369
Sandberg	16	34.8	4517	118.7	95	63	91	61	90	61	87	59	67	65	32	17	21	24	4427
Sanger	13	36.7	364	119.6	105	72	101	70	100	70	96	68	74	72	37	24	30	34	
Santa Ana FS	8	33.8	115	117.8	98	70	91	68	89	68	84	67	72	70	26	33	35	38	1430
Santa Barbara AP	6	34.4	9	119.8	90	69	83	67	81	67	77	65	70	68	20	29	34	36	2487
Santa Barbara CO	6	34.4	5	119.7	91	69	84	67	82	67	78	65	70	68	22	33	38	40	1994
Santa Clara Univ	4	37.4	88	121.9	90	67	87	65	86	65	82	63	69	67	30	29	34	36	2566
Santa Clarita	9	34.4	1300	118.5	103	71	98	70	97	70	93	68	74	72	36	30	35	37	
Santa Cruz	3	37	125	122	94	68	88	66	86	66	81	64	69	67	28	27	32	35	3136
Santa Fe Springs	9	33.9	280	118.1	99	69	90	68	88	68	84	67	72	70	24	31	36	38	
Santa Maria AP	5	34.9	236	120.5	90	66	83	64	82	63	78	61	67	65	23	25	31	33	3053
Santa Monica	6	34	15	118.5	85	67	78	66	76	66	72	64	69	67	15	39	44	46	1873
Santa Paula	9	34.4	263	119.1	101	71	94	70	92	70	87	68	73	71	28	28	33	35	2030
Santa Rosa	2	38.5	167	122.8	99	69	96	68	95	68	92	66	71	69	35	24	27	29	2980
Santee	10	32.8	400	117	96	69	91	68	90	68	87	67	72	70	20	25	30	33	
Saratoga	4	37.3	500	122	96	67	88	66	86	66	80	65	70	68	31	27	32	35	
Sausalito	3	37.9	10	122.5	85	66	80	65	78	65	73	63	67	65	12	30	34	36	
Sawyer's Bar RS	16	41.3	2169	123.1	100	66	95	65	93	64	88	62	68	66	38	14	21	25	4102
Scotia	1	40.5	139	124.4	78	61	74	60	73	60	69	58	63	61	19	28	33	35	3954
Scotts Valley	3	37	400	122	94	68	88	66	86	66	81	64	69	67	28	27	32	35	1097

City	Climate Zone	Latitude	Elevation (ft)	Longitude	Cooling								Heating						
					0.10%		0.50%		1.00%		2.00%		Design Wetbulb 0.1%	Design Wetbulb 0.5%	Outdoor Daily Range	Winter Median of Extremes	Design Drybulb (0.2%)	Design Drybulb (0.6%)	HDD*
					DB	MCWB	DB	MCWB	DB	MCWB	DB	MCWB							
Seal Beach	6	33.8	21	118.1	94	69	86	68	84	67	80	65	71	69	15	35	40	42	1519
Seaside	3	36.6	17	122.9	85	66	79	64	77	64	73	62	67	65	20	30	35	37	
Sebastapol	2	38.4	102	122.8	99	69	96	68	95	68	92	66	71	69	35	24	27	29	1249
Selma	13	36.6	305	119.6	104	73	101	71	100	70	97	68	75	73	38	24	30	34	
Sepulveda	9	34.2	818	118.5	103	71	98	69	96	69	92	67	74	71	32	28	33	36	664
Shafter	13	35.5	345	119.2	106	71	102	70	101	70	98	68	74	72	28	24	29	32	2185
Shasta Dam	11	40.7	1076	122.4	105	69	101	68	99	68	95	67	72	70	27	29	34	36	2943
Shelter Cove	1	40	110	124.1	80	61	73	60	72	59	68	57	63	61	15	34	39	41	
Sherman Oaks	9	34.2	657	118.5	103	71	98	69	96	69	92	67	74	71	28	29	34	37	664
Sierra City	16	39.6	4230	120.1	96	62	93	61	92	61	89	59	66	64	43	12	19	24	
Sierra Madre	9	34.2	1153	118.1	102	69	96	68	94	68	90	67	73	71	27	32	37	39	
Sierraville RS	16	39.6	4975	120.4	94	60	91	59	90	59	86	57	64	62	44	-10	-4	0	6893
Signal Hill	6	33.5	100	118.2	99	70	90	69	88	68	84	66	72	70	19	35	39	42	
Simi Valley	9	34.4	500	118.8	98	70	93	68	91	68	87	66	73	71	30	28	33	35	
Solana Beach	7	33	15	117.3	87	68	83	67	81	67	77	65	70	68	10	35	39	41	
Soledad	3	36.4	200	121.3	90	67	87	65	86	65	82	64	70	67	23	24	29	32	1020
Sonoma	2	38.3	70	122.5	101	70	96	69	94	69	90	67	72	70	40	22	28	31	2998
Sonora RS	12	38	1749	120.4	103	68	100	67	99	67	95	66	72	70	34	20	26	29	3537
Soquel	3	37	50	122	94	67	88	66	86	65	81	63	69	67	24	27	32	35	1097
South El Monte	9	34	270	118.1	101	72	97	70	95	70	91	68	74	72	28	31	36	38	
South Entr Yosemite	16	37.5	5120	119.6	92	61	88	60	87	60	84	59	64	62	36	8	15	20	5789
South Gate	8	33.9	120	118.2	97	70	90	69	88	69	84	67	72	70	21	32	37	39	
South Laguna	6	33.6	100	117.7	91	69	83	68	82	68	78	66	71	69	18	30	33	36	586
South Lake Tahoe	16	38.9	6200	120	85	56	82	55	79	55	71	54	60	58	33	-2	3	10	
South Oroville	11	39.5	174	121.6	106	71	104	70	102	70	98	69	74	72	37	25	30	33	1385

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					0.10%		0.50%		1.00%		2.00%		Design Wetbulb 0.1%	Design Wetbulb 0.5%	Outdoor Daily Range	Winter Median of Extremes	Design Drybulb (0.2%)	Design Drybulb (0.6%)	HDD*
					DB	MCWB	DB	MCWB	DB	MCWB	DB	MCWB							
South Pasadena	9	34	657	118.2	99	69	94	68	92	68	88	67	73	71	30	31	36	38	
South San Francisco	3	37.7	10	122.4	87	67	81	64	78	64	72	62	68	65	20	32	36	38	
South San Gabriel	9	34.1	450	118.1	99	70	94	69	92	69	88	68	73	71	73	30	35	37	431
South Whittier	9	33.9	300	118	100	70	92	69	90	69	84	68	73	71	30	31	36	38	
South Yuba City	11	39.1	59	121.6	105	69	101	69	100	69	96	68	72	71	36	24	29	32	1160
Spring Valley	10	32.7	300	117	94	69	86	68	85	68	82	66	71	69	30	34	38	41	
Squaw Valley	16	39.2	6235	120.2	88	57	85	56	84	56	80	54	61	59	40	-10	-4	0	
Squirrel Inn	16	34.2	5680	117.2	86	61	82	60	81	60	77	58	65	63	23	12	18	22	5175
Stanford	4	37.5	23	122.1	93	66	85	64	83	64	77	62	68	66	25	26	31	34	1103
Stanton	8	33.6	45	118	98	69	91	68	89	68	84	67	72	70	24	31	36	38	
Stockton AP	12	37.9	22	121.3	103	71	98	69	97	69	93	67	73	71	35	24	28	30	2806
Stockton FS 4	12	38	12	121.3	101	70	96	68	95	68	91	67	72	70	37	24	28	30	2846
Stony Gorge Res	11	39.6	791	122.5	104	70	99	69	97	69	93	67	72	70	37	21	27	30	3149
Strawberry Valley	16	39.6	3808	121.1	96	63	93	62	92	62	88	60	66	64	32	14	21	25	5120
Studio City	9	34.3	620	118.4	102	70	97	69	95	69	91	67	73	71	31	28	33	36	664
Suisun City	12	38.2	72	122	103	71	98	69	96	68	91	66	73	70	35	24	29	32	1299
Sun City	10	33.7	1420	117.2	105	70	101	69	100	69	97	68	74	72	39	22	27	30	827
Sunland	16	34.3	1460	118.3	107	71	102	70	100	70	96	68	74	72	36	28	33	36	
Sunnyvale	4	37.3	97	122	96	68	88	66	86	66	80	64	70	68	26	29	34	36	2511
Susanville AP	16	40.4	4148	120.6	98	62	95	61	94	61	90	59	66	64	38	-1	4	11	6233
Taft	13	35.1	987	119.5	106	71	102	70	101	70	98	68	74	72	34	26	31	35	934
Tahoe City	16	39.2	6230	120.1	84	56	81	55	80	55	76	53	60	58	36	2	7	14	8085
Tahoe Valley AP	16	38.9	6254	120.0	85	56	82	55	81	55	77	53	60	58	38	-5	2	6	
Tamalpais-Homestead Valley	3	37.9	25	122.5	97	68	91	66	89	66	84	64	70	68	28	28	33	35	874

City	Climate Zone	Latitude	Elevation (ft)	Longitude	Cooling								Heating						
					0.10%		0.50%		1.00%		2.00%		Design Wetbulb 0.1%	Design Wetbulb 0.5%	Outdoor Daily Range	Winter Median of Extremes	Design Drybulb (0.2%)	Design Drybulb (0.6%)	HDD*
					DB	MCWB	DB	MCWB	DB	MCWB	DB	MCWB							
Tarzana	9	34.2	800	118.6	104	71	99	69	97	69	93	68	74	71	27	27	32	35	664
Tehachapi	16	35.1	3975	118.5	97	66	93	65	92	65	89	64	69	67	33	13	20	24	4494
Tejon Rancho	16	35	1425	118.8	107	71	103	70	102	70	99	68	74	72	27	24	29	32	2602
Temecula	10	33.5	1006	117.2	101	69	96	68	95	68	91	67	73	71	34	24	29	32	
Temple City	9	34.1	403	118.1	101	70	95	69	93	69	89	68	73	71	27	30	35	37	
Termo	16	40.9	5300	120.5	95	60	92	59	91	59	87	57	64	62	37	-17	-11	-4	
Thermal AP	15	33.6	-112	116.1	114	74	110	74	109	74	106	74	80	79	29	26	31	35	1154
Thermalito	11	37.9	25	121.6	106	71	104	70	102	70	98	69	74	72	37	25	30	33	
Thousand Oaks	9	34.2	810	118.8	98	69	93	68	92	68	88	67	72	70	30	27	32	35	
Three Rivers PH 1	13	36.5	1140	118.9	105	70	102	69	101	69	98	67	73	71	38	24	30	32	2642
Tiburon	3	37.9	90	122.5	85	66	80	65	78	65	73	63	67	65	12	30	34	36	
Tiger Creek PH	16	38.5	2355	120.5	100	66	96	65	95	65	92	63	69	67	36	20	26	29	3795
Torrance	6	33.8	110	118.3	93	69	86	68	84	68	80	66	71	69	18	32	37	39	1859
Tracy Carbona	12	37.7	140	121.4	102	70	97	68	95	68	90	67	72	70	38	24	29	32	2704
Tracy Pumps	12	37.8	61	121.4	104	71	99	69	97	69	92	68	73	71	39	23	28	31	
Travis AFB	12	38.3	72	121.9	103	71	98	69	96	68	91	66	73	70	35	24	29	32	2725
Trinity Dam	16	40.8	2500	122.8	99	65	94	64	92	64	88	62	68	66	37	17	24	28	
Trona	14	35.8	1695	117.4	113	72	109	70	108	70	105	68	76	73	35	18	24	27	2415
Truckee RS	16	39.3	5995	120.2	90	58	87	57	86	57	82	55	62	60	40	-10	-4	0	8230
Tujunga	16	34.3	1820	118.3	103	70	99	69	98	69	94	67	73	71	36	20	26	29	
Tulare	13	36.2	290	119.4	105	72	101	71	100	71	96	69	74	72	39	24	30	34	
Tulelake	16	42	4035	121.5	92	60	88	59	87	59	83	57	63	61	41	-5	0	6	6854
Turlock	12	37.5	100	120.9	104	72	100	70	99	70	95	68	74	72	40	24	30	34	
Turntable Creek	16	40.8	1067	120.9	105	69	101	68	99	68	95	66	72	70	28	24	29	32	
Tustin Foothills	8	33.8	500	117.8	99	71	92	69	90	69	85	68	73	71	27	28	31	34	550

City	Climate Zone	Latitude	Elevation (ft)	Longitude	Cooling								Heating						
					0.10%		0.50%		1.00%		2.00%		Design Wetbulb 0.1%	Design Wetbulb 0.5%	Outdoor Daily Range	Winter Median of Extremes	Design Drybulb (0.2%)	Design Drybulb (0.6%)	HDD*
					DB	MCWB	DB	MCWB	DB	MCWB	DB	MCWB							
Tustin Irvine Rch	8	33.7	118	117.8	99	71	92	69	90	69	85	68	73	71	27	28	31	34	1856
Twentynine Palms	14	34.1	1975	116.1	110	71	107	70	106	70	103	69	76	74	31	21	26	29	1973
Twin Lakes	16	38.7	7829	119.1	73	49	64	47	62	47	57	46	53	50	30	-7	-2	4	9196
Twitchell Dam	5	35	582	120.3	99	70	93	68	92	68	88	66	71	69	26	26	31	34	
UCLA	9	34.1	430	118.4	93	69	86	68	84	68	80	66	71	69	20	39	43	46	1509
Ukiah	2	39.2	623	123.2	100	70	97	69	96	69	92	68	72	71	42	22	28	31	2958
Union City	3	37.6	5	122.1	90	67	87	66	85	65	81	63	69	67	20	25	30	33	
Upland	10	34.1	1605	117.7	102	69	98	68	96	68	92	66	73	71	31	29	34	36	2175
Upper Lake RS	2	39.2	1347	123	98	68	95	67	94	66	91	64	73	71	39	18	34	36	
Upper San Leandro	3	37.8	394	122.1	93	67	87	66	85	65	80	63	69	67	22	28	33	35	
Vacaville	12	38.4	105	122	103	71	100	70	98	70	94	68	73	71	40	23	28	31	2788
Valinda	9	34	340	117.9	102	70	98	69	96	69	92	68	74	72	28	31	36	38	
Valle Vista	10	33.8	1655	116.9	109	70	104	69	103	69	101	67	74	72	40	20	25	28	
Vallejo	3	38.1	85	122.3	93	67	90	66	88	66	84	64	70	68	23	28	33	36	
Valyermo RS	14	34.5	3600	117.9	100	67	96	66	95	66	91	65	70	68	41	12	19	24	3870
Van Nuys	9	34.2	708	118.5	103	71	98	69	96	69	92	67	74	71	30	28	33	39	664
Vandenburg AFB	5	34.7	368	122.8	85	62	77	61	75	61	71	60	64	62	16	30	35	37	3451
Ventura	6	34.3	341	119.3	89	68	82	67	80	67	76	66	70	68	15	29	34	36	
Victorville Pumps	14	34.5	2858	117.3	105	67	101	65	100	64	97	62	70	68	39	14	24	27	3191
View Park	6, 8	34	300	118.3	95	69	88	68	85	68	78	66	71	69	18	36	40	43	
Villa Park	8	33.8	300	117.8	99	70	92	68	90	68	85	67	72	70	27	33	37	40	550
Vincent	9	34.5	3135	118.1	105	67	101	65	100	65	96	64	71	69	33	10	18	22	1455
Visalia	13	36.3	325	119.3	103	71	100	70	99	70	96	69	73	72	38	25	30	33	2459
Vista	10	33.2	510	117.2	96	69	90	68	89	68	85	67	72	70	16	30	35	37	
Volta PH	12	40.5	2220	120.9	101	66	98	65	97	65	93	63	69	67	33	21	27	30	

City	Climate Zone	Latitude	Elevation (ft)	Longitude	Cooling								Heating						
					0.10%		0.50%		1.00%		2.00%		Design Wetbulb 0.1%	Design Wetbulb 0.5%	Outdoor Daily Range	Winter Median of Extremes	Design Drybulb (0.2%)	Design Drybulb (0.6%)	HDD*
					DB	MCWB	DB	MCWB	DB	MCWB	DB	MCWB							
Walnut	9	34	550	117.9	101	70	97	69	96	69	92	69	74	72	30	28	33	35	
Walnut Creek	12	37.9	245	122.1	100	69	94	67	92	67	87	66	71	69	32	23	29	31	
Walnut Grove	12	38.2	23	121.5	102	70	98	69	96	69	92	68	72	71	37	24	30	32	
Walnut Park	8	33.9	45	118.2	92	69	84	68	82	68	78	66	71	69	12	37	42	44	450
Warner Springs	14	33.3	3180	116.6	100	67	95	66	94	66	91	65	71	69	40	15	22	26	3591
Wasco	13	35.6	333	119.3	105	71	101	70	100	70	97	68	74	72	36	23	28	31	2466
Watsonville	3	36.9	95	121.8	86	66	82	64	81	63	79	61	68	65	22	28	33	35	3418
Weaverville RS	16	40.7	2050	122.9	100	67	95	66	93	65	89	63	69	67	46	10	17	22	4992
Weed FD	16	41.4	3590	122.4	92	63	89	62	88	61	84	59	65	63	35	4	12	17	
West Athens	8	33.9	25	118.3	92	69	85	68	84	68	80	66	71	69	18	32	37	39	450
West Carson	6	33.8	100	118.3	92	69	87	68	85	68	81	66	71	69	18	32	37	39	
West Compton	8	33.9	71	118.3	97	69	90	68	88	68	83	67	72	70	21	33	37	39	450
West Covina	9	34	365	117.9	102	70	98	69	96	69	92	68	74	72	34	29	34	36	
West Hollywood	9	34	290	118.4	95	70	89	69	87	69	82	67	72	70	20	38	42	45	
West Pittsburg	12	38	12	121.9	102	70	97	68	95	68	90	67	72	70	34	26	32	35	
West Puente Valley	9	34	500	117.9	101	71	97	70	95	70	91	68	73	71	26	31	36	39	
West Sacramento	12	38.6	19	121.5	104	72	100	70	98	70	94	68	74	71	35	26	31	33	1290
West Whittier-Los Nietos	9	34	320	118.1	99	69	90	68	88	68	84	67	72	70	24	31	35	38	
Westlake Village	9	34.2	750	118.8	103	71	99	70	98	70	94	69	73	71	26	26	30	33	
Westminster	6	33.8	38	118	95	70	88	68	86	68	81	67	72	70	23	33	38	41	
Westmont	8	33.9	110	118.3	96	70	89	69	87	69	83	67	72	70	20	36	41	44	400
Whiskeytown Res	11	40.6	1295	122.6	105	69	101	68	100	68	96	67	72	70	31	25	30	33	
White Mtn 1	16	37.5	10150	119.3	73	49	69	47	68	47	65	45	53	50	37	-15	-9	-6	
White Mtn 2	16	37.6	12470	119.3	61	42	58	41	57	41	54	40	46	43	38	-20	-15	-12	

City	Climate Zone	Latitude	Elevation (ft)	Longitude	Cooling								Heating						
					0.10%		0.50%		1.00%		2.00%		Design Wetbulb 0.1%	Design Wetbulb 0.5%	Outdoor Daily Range	Winter Median of Extremes	Design Drybulb (0.2%)	Design Drybulb (0.6%)	HDD*
					DB	MCWB	DB	MCWB	DB	MCWB	DB	MCWB							
<u>Whittier</u>	<u>9</u>	<u>34</u>	<u>320</u>	<u>118</u>	<u>99</u>	<u>69</u>	<u>90</u>	<u>68</u>	<u>88</u>	<u>68</u>	<u>84</u>	<u>67</u>	<u>72</u>	<u>70</u>	<u>24</u>	<u>31</u>	<u>35</u>	<u>38</u>	
<u>Wildomar</u>	<u>10</u>	<u>33.6</u>	<u>1255</u>	<u>117.3</u>	<u>103</u>	<u>70</u>	<u>99</u>	<u>69</u>	<u>98</u>	<u>69</u>	<u>94</u>	<u>68</u>	<u>74</u>	<u>72</u>	<u>36</u>	<u>23</u>	<u>28</u>	<u>30</u>	<u>827</u>
<u>Wildrose RS</u>	<u>16</u>	<u>36.3</u>	<u>4100</u>		<u>100</u>	<u>64</u>	<u>97</u>	<u>63</u>	<u>96</u>	<u>63</u>	<u>93</u>	<u>61</u>	<u>68</u>	<u>66</u>	<u>33</u>	<u>13</u>	<u>20</u>	<u>24</u>	
<u>Williams</u>	<u>11</u>	<u>39.2</u>	<u>85</u>	<u>122.2</u>	<u>104</u>	<u>71</u>	<u>100</u>	<u>70</u>	<u>98</u>	<u>70</u>	<u>94</u>	<u>68</u>	<u>73</u>	<u>71</u>	<u>36</u>	<u>24</u>	<u>29</u>	<u>32</u>	
<u>Willits</u>	<u>2</u>	<u>39.4</u>	<u>1350</u>	<u>123.3</u>	<u>95</u>	<u>66</u>	<u>89</u>	<u>65</u>	<u>87</u>	<u>64</u>	<u>82</u>	<u>62</u>	<u>68</u>	<u>66</u>	<u>38</u>	<u>18</u>	<u>24</u>	<u>27</u>	
<u>Willow Brook</u>	<u>8</u>	<u>33.9</u>	<u>60</u>	<u>118.2</u>	<u>97</u>	<u>70</u>	<u>90</u>	<u>69</u>	<u>88</u>	<u>69</u>	<u>83</u>	<u>67</u>	<u>72</u>	<u>70</u>	<u>21</u>	<u>35</u>	<u>39</u>	<u>42</u>	
<u>Willow Creek</u>	<u>2</u>	<u>41</u>	<u>461</u>	<u>123</u>	<u>104</u>	<u>70</u>	<u>98</u>	<u>68</u>	<u>96</u>	<u>68</u>	<u>92</u>	<u>66</u>	<u>71</u>	<u>69</u>	<u>35</u>	<u>22</u>	<u>28</u>	<u>31</u>	
<u>Willows</u>	<u>11</u>	<u>39.5</u>	<u>140</u>	<u>122.2</u>	<u>104</u>	<u>71</u>	<u>100</u>	<u>70</u>	<u>98</u>	<u>70</u>	<u>94</u>	<u>68</u>	<u>73</u>	<u>71</u>	<u>36</u>	<u>22</u>	<u>28</u>	<u>31</u>	<u>2836</u>
<u>Windsor</u>	<u>2</u>	<u>38.5</u>	<u>130</u>	<u>122.8</u>	<u>99</u>	<u>69</u>	<u>96</u>	<u>68</u>	<u>95</u>	<u>68</u>	<u>92</u>	<u>66</u>	<u>71</u>	<u>69</u>	<u>35</u>	<u>24</u>	<u>27</u>	<u>29</u>	<u>1249</u>
<u>Winters</u>	<u>12</u>	<u>38.5</u>	<u>135</u>	<u>122</u>	<u>104</u>	<u>71</u>	<u>99</u>	<u>70</u>	<u>97</u>	<u>70</u>	<u>93</u>	<u>68</u>	<u>73</u>	<u>71</u>	<u>38</u>	<u>24</u>	<u>29</u>	<u>32</u>	<u>2593</u>
<u>Winton</u>	<u>12</u>	<u>37.4</u>	<u>168</u>	<u>120.6</u>	<u>103</u>	<u>71</u>	<u>100</u>	<u>69</u>	<u>99</u>	<u>69</u>	<u>95</u>	<u>67</u>	<u>73</u>	<u>71</u>	<u>36</u>	<u>21</u>	<u>27</u>	<u>30</u>	<u>1244</u>
<u>Woodcrest</u>	<u>10</u>	<u>33.9</u>	<u>1500</u>	<u>117.4</u>	<u>104</u>	<u>70</u>	<u>100</u>	<u>69</u>	<u>99</u>	<u>68</u>	<u>95</u>	<u>65</u>	<u>74</u>	<u>72</u>	<u>37</u>	<u>27</u>	<u>32</u>	<u>35</u>	<u>611</u>
<u>Woodfords</u>	<u>16</u>	<u>38.8</u>	<u>5671</u>	<u>119.8</u>	<u>92</u>	<u>59</u>	<u>89</u>	<u>58</u>	<u>88</u>	<u>58</u>	<u>84</u>	<u>56</u>	<u>63</u>	<u>61</u>	<u>32</u>	<u>0</u>	<u>5</u>	<u>12</u>	<u>6047</u>
<u>Woodlake</u>	<u>13</u>	<u>36.3</u>	<u>500</u>	<u>119.1</u>	<u>103</u>	<u>71</u>	<u>100</u>	<u>70</u>	<u>99</u>	<u>70</u>	<u>96</u>	<u>69</u>	<u>73</u>	<u>72</u>	<u>38</u>	<u>25</u>	<u>30</u>	<u>33</u>	<u>1130</u>
<u>Woodland</u>	<u>12</u>	<u>38.7</u>	<u>69</u>	<u>121.8</u>	<u>106</u>	<u>72</u>	<u>101</u>	<u>71</u>	<u>100</u>	<u>71</u>	<u>96</u>	<u>69</u>	<u>74</u>	<u>72</u>	<u>40</u>	<u>25</u>	<u>30</u>	<u>33</u>	<u>2708</u>
<u>Woodland Hills</u>	<u>9</u>	<u>34.2</u>	<u>944</u>	<u>118.6</u>	<u>104</u>	<u>71</u>	<u>99</u>	<u>70</u>	<u>97</u>	<u>70</u>	<u>93</u>	<u>68</u>	<u>74</u>	<u>72</u>	<u>32</u>	<u>26</u>	<u>31</u>	<u>34</u>	<u>664</u>
<u>Woodside</u>	<u>3</u>	<u>37.5</u>	<u>75</u>	<u>122.3</u>	<u>92</u>	<u>67</u>	<u>84</u>	<u>66</u>	<u>82</u>	<u>65</u>	<u>76</u>	<u>63</u>	<u>69</u>	<u>67</u>	<u>24</u>	<u>22</u>	<u>28</u>	<u>31</u>	
<u>Yorba Linda</u>	<u>8</u>	<u>33.9</u>	<u>350</u>	<u>117.8</u>	<u>102</u>	<u>70</u>	<u>94</u>	<u>69</u>	<u>92</u>	<u>69</u>	<u>88</u>	<u>68</u>	<u>73</u>	<u>71</u>	<u>31</u>	<u>30</u>	<u>35</u>	<u>37</u>	<u>1643</u>
<u>Yosemite Park Hq</u>	<u>16</u>	<u>37.7</u>	<u>3970</u>	<u>119.6</u>	<u>97</u>	<u>63</u>	<u>94</u>	<u>62</u>	<u>93</u>	<u>62</u>	<u>90</u>	<u>60</u>	<u>67</u>	<u>65</u>	<u>38</u>	<u>11</u>	<u>18</u>	<u>23</u>	<u>4785</u>
<u>Yreka</u>	<u>16</u>	<u>41.7</u>	<u>2625</u>	<u>122.6</u>	<u>99</u>	<u>66</u>	<u>95</u>	<u>65</u>	<u>94</u>	<u>65</u>	<u>90</u>	<u>64</u>	<u>69</u>	<u>67</u>	<u>39</u>	<u>8</u>	<u>15</u>	<u>20</u>	<u>5395</u>
<u>Yuba City</u>	<u>11</u>	<u>39.1</u>	<u>70</u>	<u>121.6</u>	<u>105</u>	<u>69</u>	<u>101</u>	<u>69</u>	<u>100</u>	<u>69</u>	<u>96</u>	<u>68</u>	<u>72</u>	<u>71</u>	<u>36</u>	<u>24</u>	<u>29</u>	<u>32</u>	
<u>Yucaipa</u>	<u>10</u>	<u>34</u>	<u>2600</u>	<u>117</u>	<u>106</u>	<u>68</u>	<u>102</u>	<u>67</u>	<u>101</u>	<u>67</u>	<u>98</u>	<u>65</u>	<u>73</u>	<u>71</u>	<u>35</u>	<u>27</u>	<u>32</u>	<u>35</u>	
<u>Yucca Valley</u>	<u>14</u>	<u>34.2</u>	<u>2600</u>	<u>116.4</u>	<u>108</u>	<u>71</u>	<u>105</u>	<u>70</u>	<u>104</u>	<u>70</u>	<u>101</u>	<u>69</u>	<u>75</u>	<u>73</u>	<u>32</u>	<u>19</u>	<u>24</u>	<u>27</u>	<u>862</u>

***Heating Degree Day** is a unit, based on 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 (18°C), there exist as many degree days as there are Fahrenheit degrees difference in temperature between mean temperature for the day and 65°F (18°C).

KEY TO ABBREVIATIONS:

AFB	Air Force Base
AFS	Air Force Station
AP	Airport
CO	City/County Office
FD	Fire Department
FS	Fire Station
MCB	Marine Corps Base
MWWB	Mean Coincident Wet Bulb
NAS	Naval Air Station
NM	National Monument
PH	Power House
RS	Ranger Station

JA2.3 23 WYEC2 Climate/Weather Data Format

The ASCII versions of the WYEC2 weather files consist of 8760 identical fixed format records, one for each hour of a 365-day year. Each record is 116 characters in length and is organized according to the format shown in Table 2-4, which follows.

The WYEC2 format is derived from the NOAA TD-9734 Typical Meteorological Year (TMY) format in that WYEC2 uses the same field encoding and units as TMY. However, it should be noted that **all WYEC2 values are for Local Standard Time**. That is, WYEC2 data should be read sequentially and used with no conversion (except any required unit conversions). This is in marked contrast to the TMY files which contain solar data for Apparent Solar Time and meteorological data for Local Standard Time.

Irradiance and illuminance fields contain data integrated over the hour; meteorological fields contain observations made at the end of the hour. For example, hour 12 contains irradiance/illuminance integrated from 11-12 and meteorological observations made at 12.

Table 2-4 – WYEC DATA FORMAT

Field Number	Data Positions	Flag Position (see notes)	Data Element and Description
-001	001-005	--	WBAN station identification number - Unique number to identify each station - California compliance files contain 00001 – 00016 in this field to indicate the climate zone
-002	006-006	--	File source code - W = WYEC - T = TMY - C = California Compliance
-003	007-014	--	Time, Yr Mo Day Hr (2 chars each) - Yr omits the "19" and indicates the source year for the data, i.e., 00 = 1900, 99 = 1999. Data within a single WYEC2 file may have been observed in more than one year. - Mo is 1 to 12. - Day is 1 to month length (28, 30, or 31). - Hr is 1 to 24.
-101	015-018	--	Extraterrestrial irradiance, kJ/m² - Amount of solar energy received at top of atmosphere during solar hour ending at time indicated in field 003, based on solar constant of 1367 kJ/m ² . - Nighttime values are shown as 0.
-102	019-022	023-024	Global horizontal irradiance, kJ/m² - Total of direct and diffuse radiant energy received on a horizontal surface by a pyranometer during the hour ending at the time indicated in field 003.
-103	025-028	029-030	Direct normal irradiance, kJ/m² - Portion of the radiant energy received at the pyrheliometer directly from the sun during the hour ending at the time indicated in field 003.
-104	031-034	035-036	Diffuse horizontal irradiance, kJ/m² - Amount of radiant energy in kJ/m ² received at the instrument indirectly from the sky during the hour ending at the time indicated in field 003.
-105	037-040	041	Global horizontal illuminance, lux * 100
-106	042-045	046	Direct normal illuminance, lux * 100
-107	047-050	051	Diffuse horizontal illuminance, lux * 100
-108	052-055	056	Zenith luminance, Cd/m² * 100
-110	057-058	059	Minutes of sunshine, 0 – 60 minutes
-201	060-063	064	Ceiling Height, m * 10

Field Number	Data Positions	Flag-Position (see notes)	Data Element and Description
			<p>-Ceiling is defined as opaque sky cover of 0.6 or greater.</p> <p>-0000-3000 = 0 to 30,000 m</p> <p>-7777 = unlimited; clear</p> <p>-8888 = unknown height of cirroform ceiling</p>
-202	065-068	069	<p>Sky Condition</p> <p>-All observations assumed to be made after 1 June 1951 ("indicator" at position 77 in TMY is omitted).</p> <p>-Coded by layer in ascending order; four layers are described; if less than 4 layers are present the remaining positions are coded 0. The code for each layer is:</p> <p>0 = Clear of less than 0.1 cover</p> <p>1 = Thin scattered (0.1-0.5 cover)</p> <p>2 = Opaque scattered (0.1-0.5 cover)</p> <p>3 = Thin broken (0.6-0.9 cover)</p> <p>4 = Opaque broken (0.6-0.9 cover)</p> <p>5 = Thin overcast (1.0 cover)</p> <p>6 = Opaque overcast (1.0 cover)</p> <p>7 = Obscuration</p> <p>8 = Partial obscuration</p>
-203	070-073	074	<p>Visibility, m * 100</p> <p>-Prevailing horizontal visibility.</p> <p>-0000-1600 = 0 to 160 kilometers</p> <p>-8888 = unlimited</p>
-204	-075-082	083	<p>Weather</p> <p>-Eight single digit codes as follows:</p>
204 (cont.)	075		<p>Occurrence of thunderstorm, tornado or squall.</p> <p>0 = None</p> <p>1 = Thunderstorm - lightning and thunder. Wind gusts less than 50 knots, and hail, if any, less than 3/4 inch diameter.</p> <p>2 = Heavy or severe thunderstorm - frequent intense lightning and thunder. Wind gusts 50 knots or greater and hail, if any, 3/4 inch or greater diameter.</p> <p>3 = Report of tornado or waterspout.</p> <p>4 = Squall (sudden increase of wind speed by at least 16 knots, reach 22 knots or more and lasting for at least one minute).</p>
-204 (cont.)	-076		<p>Occurrence of rain, rain showers or freezing rain:</p> <p>0 = None</p> <p>1 = Light rain</p> <p>2 = Moderate rain</p> <p>3 = Heavy rain</p> <p>4 = Light rain showers</p> <p>5 = Moderate rain showers</p> <p>6 = Heavy rain showers</p> <p>7 = Light freezing rain</p> <p>8 = Moderate or heavy freezing rain</p>
-204 (cont.)	-077		<p>Occurrence of drizzle, freezing drizzle:</p> <p>0 = None</p> <p>1 = Light drizzle</p> <p>2 = Moderate drizzle</p> <p>3 = Heavy drizzle</p> <p>4 = Light freezing drizzle</p> <p>5 = Moderate freezing drizzle</p> <p>6 = Heavy freezing drizzle</p>
-204	-078		<p>Occurrence of snow, snow pellets or ice crystals:</p>

Field Number	Data Positions	Flag Position (see notes)	Data Element and Description
(cont.)			<p>-0 = None</p> <p>-1 = Light snow</p> <p>-2 = Moderate snow</p> <p>-3 = Heavy snow</p> <p>-4 = Light snow pellets</p> <p>-5 = Moderate snow pellets</p> <p>-6 = Heavy snow pellets</p> <p>-7 = Light ice crystals</p> <p>-8 = Moderate ice crystals</p> <p>Beginning April 1963 intensities of ice crystals were discontinued. All occurrences since this date are recorded as an 8.</p>
-204 (cont.)	-079		<p>Occurrence of snow showers or snow grains:</p> <p>-0 = None</p> <p>-1 = Light snow showers</p> <p>-2 = Moderate snow showers</p> <p>-3 = Heavy snow showers</p> <p>-4 = Light snow grains</p> <p>-5 = Moderate snow grains</p> <p>-6 = Heavy snow grains</p> <p>Beginning April 1963 intensities of snow grains were discontinued. All occurrences since this date are recorded as a 5.</p>
-204 (cont.)	-080		<p>Occurrence of sleet (ice pellets), sleet showers or hail:</p> <p>-0 = None</p> <p>-1 = Light sleet or sleet showers (ice pellets)</p> <p>-2 = Moderate sleet or sleet showers (ice pellets)</p> <p>-3 = Heavy sleet or sleet showers (ice pellets)</p> <p>-4 = Light hail</p> <p>-5 = Moderate hail</p> <p>-6 = Heavy hail</p> <p>-7 = Light small hail</p> <p>-8 = Moderate or heavy small hail</p> <p>Prior to April 1970 ice pellets were coded as sleet. Beginning April 1970 sleet and small hail were redefined as ice pellets and are coded as a 1, 2, or 3 in this position. Beginning September 1956 intensities of hail were no longer reported and all occurrences were recorded as a 5.</p>
-204 (cont.)	-081		<p>Occurrence of fog, blowing dust or blowing sand:</p> <p>-0 = None</p> <p>-1 = Fog</p> <p>-2 = Ice Fog</p> <p>-3 = Ground Fog</p> <p>-4 = Blowing dust</p> <p>-5 = Blowing sand</p> <p>These values recorded only when visibility less than 7 miles.</p>
-204 (cont.)	-082		<p>Occurrence of smoke, haze, dust, blowing snow or blowing spray:</p> <p>-0 = None</p> <p>-1 = Smoke</p> <p>-2 = Haze</p> <p>-3 = Smoke and haze</p> <p>-4 = Dust</p> <p>-5 = Blowing snow</p> <p>-6 = Blowing spray</p> <p>These values recorded only when visibility less than 7 miles.</p>
-205	-084-088	-089	Station pressure, kilopascals (kPa) * 100

Field Number	Data Positions	Flag Position (see notes)	Data Element and Description
			Pressure at station level -08000 - 10999 = 80 to 109.99 kPa.
-206	-090-093	-094	Dry bulb temperature, °C * 10 -700 to 0600 = -70.0 to +60.0 °C
-207	-095-098	-099	Dew point, °C * 10 -700 to 0600 = -70.0 to +60.0 °C
-208	-100-102	-103	Wind direction, 0 - 359 degrees -0 = north Note TMY range is 0-360, WYEC2 has recoded 360 as 0.
-209	-104-107	-108	Wind speed, m/s * 10 -0 - 1500 = 0 to 150.0 m/s. Wind speed and wind direction both 0 indicates calm.
-210	-109-110	-111	Total Sky Cover, 0 - 10 in tenths Amount of celestial dome in tenths covered by clouds or obscuring phenomena.
-211	-112-113	-114	Opaque Sky Cover, 0 - 10 in tenths Amount of celestial dome in tenths covered by clouds or obscuration through which the sky and/or higher cloud layers cannot be seen.
-212	-115-116	-116	Snow Cover -0 = no snow or a trace of snow -1 = indicates more than a trace of snow on the ground

Notes for Table 2-4 – WYEC DATA FORMAT:

- Total file size (including CRLF's) = 118 x 8,760 = 1,033,680 characters.
- Flag characters indicate the source of the associated value and, in the case of solar fields, optionally give information about the quality of the value.

Some fields have no flag, others have 1 or 2 character flags as follows:

Field	Flag Type/Comment
001 - 003	None (record identification fields)
101	None (calculated extraterrestrial irradiance is always present)
102 - 1042	Character (irradiance values)
105 - 2121	Character (all remaining fields)

One character flags are alphabetic (with the exception of 9 for missing) and are defined as follows:

(blank) Value was observed (that is, not derived with a model and not altered.)

A Value has been algorithmically adjusted (e.g., dry bulb temperatures were shifted to match long term means).

E Value was missing and has been replaced by a hand estimate.

F Value was bad and has been replaced by a hand estimate.

I Value was missing and has been replaced with one derived by interpolation from neighboring observations.

J Value was bad and has been replaced with one derived by interpolation from neighboring observations.

M Value was missing and has been replaced with one derived with a model (model used depends on element).

- N — Value was bad and has been replaced with one derived with a model (model used depends on element).
- P — Value violated a physical limit and has been replaced by that limit.
- Q — Value is derived from other values (e.g., illuminance data which were not observed).
- 9 — Value is missing; data positions contain 9s as well.

Two character flags (on irradiance fields 102, 103, and 104) are *either*:

- A 1 — Character flag (as defined above) followed by a blank, or
- A 2 — Character numeric value in the range 00 to 99 and are defined in *SERI Standard Broadband Format 2*, as follows:
- 00 — Element is untested (original data)
 - 01-03 — Element passed tests on physical limits, model limits (for tolerances less than 3 percent), and reasonable coupling to other parameters (for tolerances less than 3 percent).
 - 04 — Element passed hand/eye tests.
 - 05 — Element failed hand/eye tests and has not been corrected.
 - 06 — Element was missing and has not been replaced with an estimate.
 - 07 — Element's value is lower than a physical limit.
 - 08 — Element's value is higher than a physical limit.
 - 09 — Element's value is inconsistent with other components (e.g. direct not consistent with global)
 - 10-93 — Element exceeded the 3 percent tolerance in one of four ways. The following error types are defined:
 - 0 = too low by 3-parameter coupling
 - 1 = too high by 3-parameter coupling
 - 2 = too low by 2D boundary comparison
 - 3 = too high by 2D boundary comparison

The flags in this range are constructed in such a way that both the percentage of error and the type of error are encoded in the two digit flag. To create the flag, one multiplies the percentage of disagreement by 4, subtract 2, and add the error type. The percentage of error should be truncated – only the integer part is used.

The particular error is determined by the remainder of $\text{MOD}(\text{IQC}+2 / 4)$, where "MOD" is a mathematical function representing the remainder of the quantity $(\text{IQC}+2)/4$ and "IQC" is the two digit flag number. The percentage error is determined by

$$\text{IPCT} = \text{Int}((\text{IQC} + 2) / 4)$$

IPCT = 23 indicates an error greater than 23 percent.

$$94-97 \text{ KN} = \text{KT} + \text{ERR}$$

FLAG	ERR
94	5% ETR <= ERR <10% ETR
95	10% ETR <= ERR <15% ETR
96	15% ETR <= ERR <20% ETR
97	20% ETR <= ERR
99	Element is missing or null.

It should be noted that the 2-character numeric flags are appropriate for encoding the results of quality control processing of archival solar data. The 1-character alphabetic flags are appropriate for "best estimate" data sets in which any questionable values have been replaced. Most WYEC2 files used for engineering purposes will fall into the latter category and will thus use the alphabetic flags on solar fields.

3. Missing elements are 9 filled: all data and flag positions contain 9s.

4. Conversion factors relevant to WYEC2 use:

To convert from	To	Multiply By
kJ/m ²	Btu/ft ²	0.08807
m/s * 10	mph	0.2273
kPa	in. Hg.	0.002953
m * 10	ft	32.808
m * 100 miles	miles	0.06214

Joint Appendix JA3

Appendix JA3 – Time Dependent Valuation (TDV)

JA3.1 Scope and Purpose

Time dependent valuation (TDV) is the currency used to compare energy performance when the performance compliance method is used. TDV is also used to evaluate the cost effectiveness of measures and to perform other codes analysis. TDV replaces source energy, which was used to compare performance prior to the 2005 Standards.

TDV consists of large data sets that convert electricity, gas or propane to TDV energy. The rate of conversion varies for each hour of the year, for each climate zone and for each energy type (electricity, natural gas or propane). The conversion factors also vary by building type: low-rise residential and other building types, including nonresidential, hotel/motel and high-rise residential. There are a total of 144 hourly data sets (16 climate zones x 3 fuel types x 3 building types) where the 3 building types are residential 30 year, nonresidential 15 year, nonresidential 30 year. ~~There are a total of 96 hourly data sets (16 climates x 3 energy types x 2 building types).~~ The actual TDV data may be downloaded from http://www.energy.ca.gov/title24/2013standards/prerulemaking/documents/general_cec_documents/2011_TDV_v3_110112.xlsx ~~http://www.energy.ca.gov/title24/2008standards/~~ or by writing to:

Time Dependent Valuation (TDV) Data
Energy Efficiency and Demand Analysis Division
California Energy Commission
1516 Ninth St., MS-28
Sacramento, CA 95814-5512

~~The tables to be used are those without externalities.~~ Because of the length, the actual data is not published in this appendix.

JA3.2 Summary of Data

~~Table 3-4~~ ~~Table 3-4~~ through ~~Table 3-6~~ ~~Table 3-3~~ give a statistical summary of the TDV conversion factors for electricity, natural gas and propane. Each table has the annual minimum, maximum, and average for each climate zone and building type.

- ~~Table 3-4 – TDV Statistical Data – Electricity (kBtu/kWh)~~ ~~Table 3-1 – TDV Statistical Data – Electricity (kBtu/kWh)~~
- ~~Table 3-5 – TDV Statistical Data – Natural Gas (kBtu/therm)~~ ~~Table 3-2 – TDV Statistical Data – Natural Gas (kBtu/therm)~~
- ~~Table 3-6 – TDV Statistical Data – Propane (kBtu/therm)~~ ~~Table 3-3 – TDV Statistical Data – Propane (kBtu/therm)~~

For electricity, there are nonresidential conversion factors for both a 15-year and a 30-year life-cycle. The 30-year factors are used to evaluate cost-effectiveness of building envelope measures; 15-year conversion factors are used to evaluate other building measures and for compliance runs. Figure 3-1 through Figure 3-8 show typical variation in the TDV conversion factors for climate zone 12 (Sacramento) for Residential and Nonresidential. Electricity variation is shown for the whole year (Figure 3-1 and Figure 3-3) and for the Month of July (Figure 3-2 and Figure 3-4). Variation is greatest for electricity. Figure 3-5 through Figure 3-8 show the annual variation for natural gas and propane; note that there is no daily or hourly variation, only monthly variation.

- Figure 3-1 – Residential Electricity – Climate Zone 12 – Annual
- Figure 3-2 – Residential Electricity – Climate Zone 12 – July
- Figure 3-3 – Nonresidential Electricity – Climate Zone 12 – Annual
- Figure 3-4 – Nonresidential Electricity – Climate Zone 12 – July
- Figure 3-5 – Residential Natural Gas – Climate Zone 12 – Annual
- Figure 3-6 – Nonresidential Natural Gas – Climate Zone 12 – Annual
- Figure 3-7 – Residential Propane – Climate Zone 12 – Annual
- Figure 3-8 – Nonresidential Propane – Climate Zone 12 – Annual

Table 3-44 – TDV Statistical Data – Electricity (kBtu/kWh)

Residential	Nonresidential (15yr)	Nonresidential (30 yr)
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Climate Zone	Minimum	Average	Maximum	Minimum	Average	Maximum	Minimum	Average	Maximum				
1	3.95 8	10.6 6	43.93 21.2	138.65 7	165.8 40	48.64 9	172.92 5	188.2 2	6.20 2	17.43 21.9	157.69 6	184.5	
2	10.68 4	4.0 6	43.94 21.2	137.55 4	237.7 35	7.68 9	48.58 3	20.8 9	172.99 6	271.4 96	6.27 6	17.40 21.8	156.44 265.3
3	10.68 8	4.2 6	43.97 21.2	137.78 4	276.5 36	8.06 9	48.70 4	20.8 9	173.37 6	317.4 97	6.62 7	17.52 21.8	156.76 308.9
4	4.17 8	10.6 6	43.96 21.2	166.14 9	254.1 35	7.89 4	48.66 9	20.8 9	201.27 6	290.9 97	6.47 7	17.48 21.8	188.63 283.8
5	4.17 7	10.6 6	43.95 21.2	137.67 5	203.7 42	7.98 9	48.73 0	20.9 5	173.29 3	231.5 3	6.55 3	17.55 21.9	156.69 227.1
6	4.07 9	9.99 3	44.00 20.5	120.77 4	343.0 1	10.32 5	29.3 2	21.20 7	157.36 4	397.1 92	8.80 7	19.97 21.7	140.05 384.4
7	7.02 8	10.7 2	47.64 21.3	165.65 0	308.1 71	3.86 5	9.71 5	21.1 2	200.08 2	352.2 3	2.78 8	14.72 22.1	181.20 344.7
8	4.06 2	10.0 6	43.98 20.5	131.80 0	240.7 2	10.32 6	29.3 3	21.18 2	164.84 8	275.8 94	8.78 9	19.94 21.7	152.45 269.3
9	4.00 9	9.87 1	43.95 20.4	184.00 9	317.5 2	10.22 6	29.2 4	21.13 4	221.40 8	367.0 84	8.71 0	19.90 21.7	211.15 355.9
10	3.94 9	9.86 0	43.92 20.4	120.64 3	241.7 0	10.10 4	9.2 4	21.08 4	157.13 8	277.3 82	8.64 8	19.87 21.6	139.89 270.6
11	3.94 9	9.86 6	43.93 21.2	182.19 2	245.8 37	7.48 5	9.37 0	20.8 0	226.28 6	281.6 98	6.07 9	17.35 21.8	206.59 274.4
12	4.04 7	10.6 6	43.94 21.2	145.38 6	208.4 38	7.62 6	9.38 1	20.8 1	176.48 9	236.8 99	6.20 9	17.38 21.8	165.20 232.4
13	4.25 8	10.6 6	43.97 21.2	155.19 5	175.5 36	8.00 4	9.36 3	20.8 3	194.14 6	197.7 97	6.57 7	17.50 21.8	176.33 195.3
14	3.93 9	9.85 9	43.92 20.3	153.08 2	153.5 0	10.10 4	9.2 1	21.08 1	195.18 8	172.8 82	8.63 8	19.87 21.6	176.37 171.4
15	3.92 9	9.87 0	43.92 20.4	133.70 7	156.9 3	10.08 7	9.2 0	21.08 0	170.12 8	176.9 85	8.62 0	19.87 21.7	154.58 175.2
16	3.85 9	9.81 5	43.93 20.3	156.86 5	225.1 17	7.43 1	9.17 2	20.6 2	188.67 80	257.7 80	6.03 5	17.37 21.6	178.14 251.9

Table 3-52 – TDV Statistical Data – Natural Gas (kBtu/therm)

Climate Zone	Residential			Nonresidential (15yr)			Nonresidential (30 year)											
	Minimum	Average	Maximum	Minimum	Average	Maximum	Minimum	Average	Maximum									
1	138.60	140.86	148.44	159.51	165.73	185.55	141.49	142.20	150.74	163.33	167.87	192.87	153.60	147.02	163.24	167.98	197.27	181.08
2	138.60	140.86	148.44	159.51	165.73	185.55	141.49	142.20	150.74	163.33	167.87	192.87	153.60	147.02	163.24	167.98	197.27	181.08
3	138.60	140.86	148.44	159.51	165.73	185.55	141.49	142.20	150.74	163.33	167.87	192.87	153.60	147.02	163.24	167.98	197.27	181.08
4	138.60	140.86	148.44	159.51	165.73	185.55	141.49	142.20	150.74	163.33	167.87	192.87	153.60	147.02	163.24	167.98	197.27	181.08
5	138.60	140.86	148.44	159.51	165.73	185.55	141.49	142.20	150.74	163.33	167.87	192.87	153.60	147.02	163.24	167.98	197.27	181.08
6	138.60	141.14	148.44	160.45	165.73	187.44	141.49	142.50	150.74	164.40	167.87	195.04	153.60	147.33	163.24	169.04	199.40	181.08
7	138.60	140.43	148.44	157.62	165.73	181.62	141.49	142.70	150.74	165.49	167.87	197.38	153.60	147.54	163.24	170.12	201.70	181.08
8	138.60	141.14	148.44	160.45	165.73	187.44	141.49	142.50	150.74	164.40	167.87	195.04	153.60	147.33	163.24	169.04	199.40	181.08
9	138.60	141.14	148.44	160.45	165.73	187.44	141.49	142.50	150.74	164.40	167.87	195.04	153.60	147.33	163.24	169.04	199.40	181.08
10	138.60	141.14	148.44	160.45	165.73	187.44	141.49	142.50	150.74	164.40	167.87	195.04	153.60	147.33	163.24	169.04	199.40	181.08
11	138.60	140.86	148.44	159.51	165.73	185.55	141.49	142.20	150.74	163.33	167.87	192.87	153.60	147.02	163.24	167.98	197.27	181.08
12	138.60	140.86	148.44	159.51	165.73	185.55	141.49	142.20	150.74	163.33	167.87	192.87	153.60	147.02	163.24	167.98	197.27	181.08
13	138.60	140.86	148.44	159.51	165.73	185.55	141.49	142.20	150.74	163.33	167.87	192.87	153.60	147.02	163.24	167.98	197.27	181.08
14	138.60	141.14	148.44	160.45	165.73	187.44	141.49	142.50	150.74	164.40	167.87	195.04	153.60	147.33	163.24	169.04	199.40	181.08
15	138.60	141.14	148.44	160.45	165.73	187.44	141.49	142.50	150.74	164.40	167.87	195.04	153.60	147.33	163.24	169.04	199.40	181.08
16	138.60	141.14	148.44	160.45	165.73	187.44	141.49	142.50	150.74	164.40	167.87	195.04	153.60	147.33	163.24	169.04	199.40	181.08

Table 3-63 – TDV Statistical Data – Propane (kBtu/therm)

Climate Zone	Residential			Nonresidential (15yr)			Nonresidential (30 year)											
	Minimum	Average	Maximum	Minimum	Average	Maximum	Minimum	Average	Maximum									
1	328.06	450.07	410.71	489.53	480.19	222.69	299.23	149.55	188.86	374.89	221.92	438.49	160.19	311.42	202.31	389.24	237.72	454.66
2	328.06	450.07	410.71	489.53	480.19	222.69	299.23	149.55	374.89	188.86	438.49	221.92	311.42	160.19	389.24	202.31	454.66	237.72
3	328.06	450.07	410.71	489.53	480.19	222.69	299.23	149.55	374.89	188.86	438.49	221.92	311.42	160.19	389.24	202.31	454.66	237.72
4	328.06	450.07	410.71	489.53	480.19	222.69	299.23	149.55	374.89	188.86	438.49	221.92	311.42	160.19	389.24	202.31	454.66	237.72
5	328.06	450.07	410.71	489.53	480.19	222.69	299.23	149.55	374.89	188.86	438.49	221.92	311.42	160.19	389.24	202.31	454.66	237.72
6	328.06	450.07	410.71	489.53	480.19	222.69	299.23	149.55	374.89	188.86	438.49	221.92	311.42	160.19	389.24	202.31	454.66	237.72
7	328.06	450.07	410.71	489.53	480.19	222.69	299.23	149.55	374.89	188.86	438.49	221.92	311.42	160.19	389.24	202.31	454.66	237.72
8	328.06	450.07	410.71	489.53	480.19	222.69	299.23	149.55	374.89	188.86	438.49	221.92	311.42	160.19	389.24	202.31	454.66	237.72
9	328.06	450.07	410.71	489.53	480.19	222.69	299.23	149.55	374.89	188.86	438.49	221.92	311.42	160.19	389.24	202.31	454.66	237.72
10	328.06	450.07	410.71	489.53	480.19	222.69	299.23	149.55	374.89	188.86	438.49	221.92	311.42	160.19	389.24	202.31	454.66	237.72
11	328.06	450.07	410.71	489.53	480.19	222.69	299.23	149.55	374.89	188.86	438.49	221.92	311.42	160.19	389.24	202.31	454.66	237.72
12	328.06	450.07	410.71	489.53	480.19	222.69	299.23	149.55	374.89	188.86	438.49	221.92	311.42	160.19	389.24	202.31	454.66	237.72
13	328.06	450.07	410.71	489.53	480.19	222.69	299.23	149.55	374.89	188.86	438.49	221.92	311.42	160.19	389.24	202.31	454.66	237.72
14	328.06	450.07	410.71	489.53	480.19	222.69	299.23	149.55	374.89	188.86	438.49	221.92	311.42	160.19	389.24	202.31	454.66	237.72
15	328.06	450.07	410.71	489.53	480.19	222.69	299.23	149.55	374.89	188.86	438.49	221.92	311.42	160.19	389.24	202.31	454.66	237.72
16	328.06	450.07	410.71	489.53	480.19	222.69	299.23	149.55	374.89	188.86	438.49	221.92	311.42	160.19	389.24	202.31	454.66	237.72

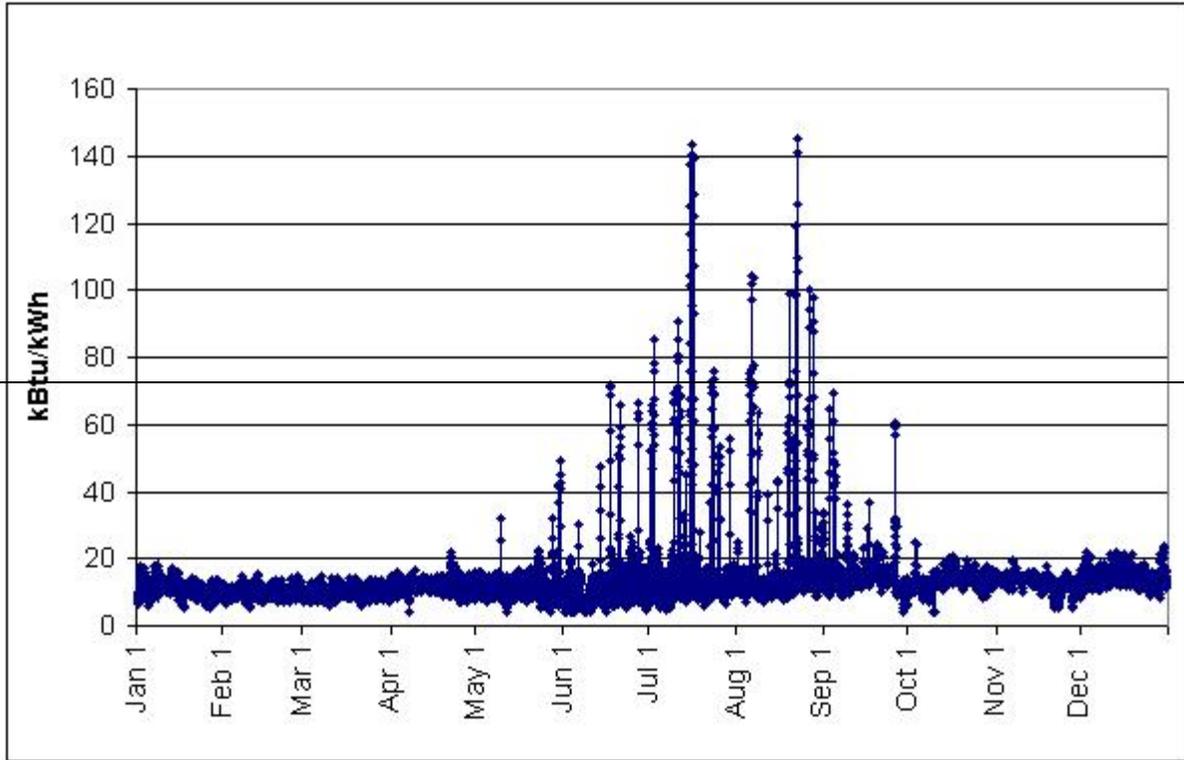


Figure 3-1 Residential Electricity Climate Zone 12 Annual

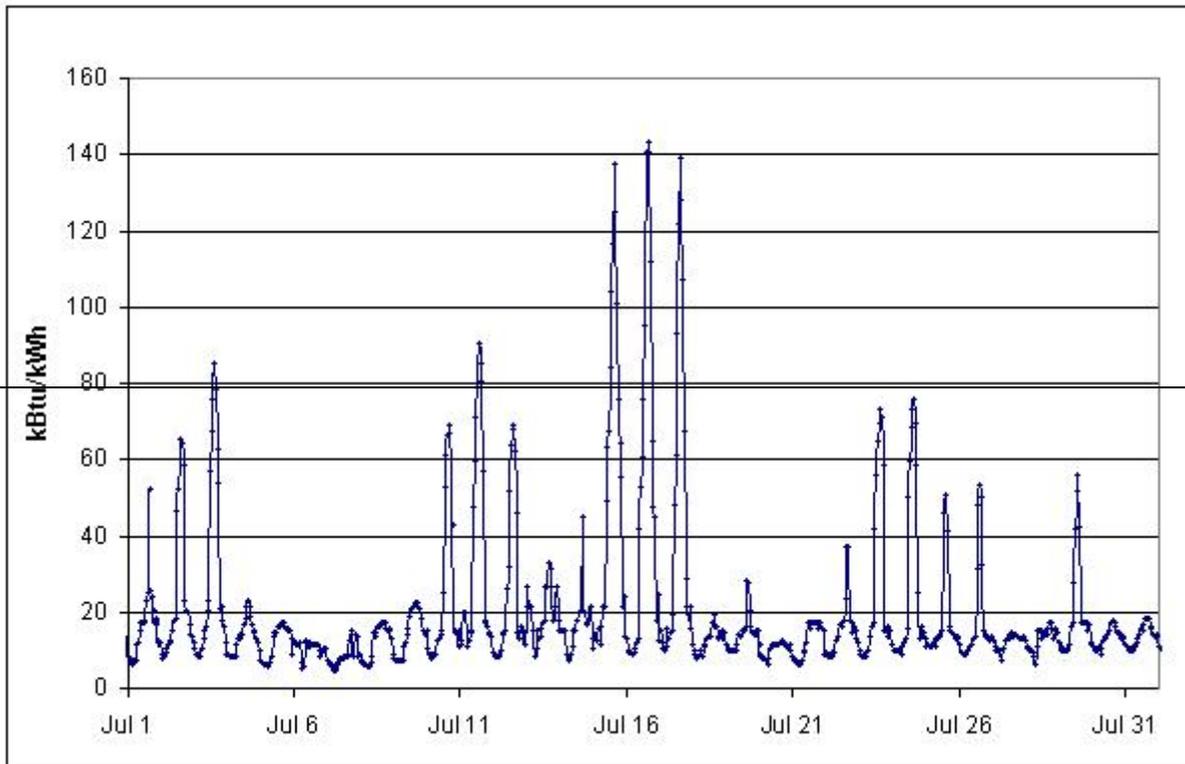


Figure 3-2— Residential Electricity— Climate Zone 12— July

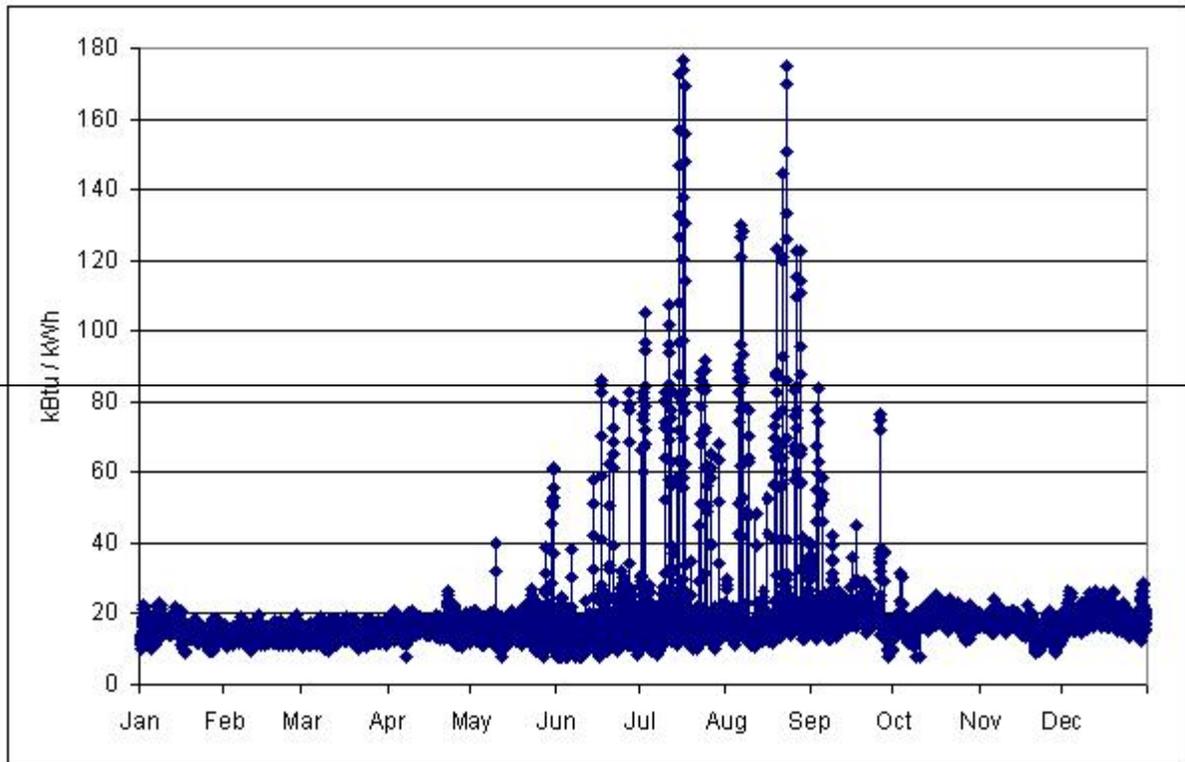


Figure 3-3—Nonresidential Electricity—Climate Zone 12—Annual

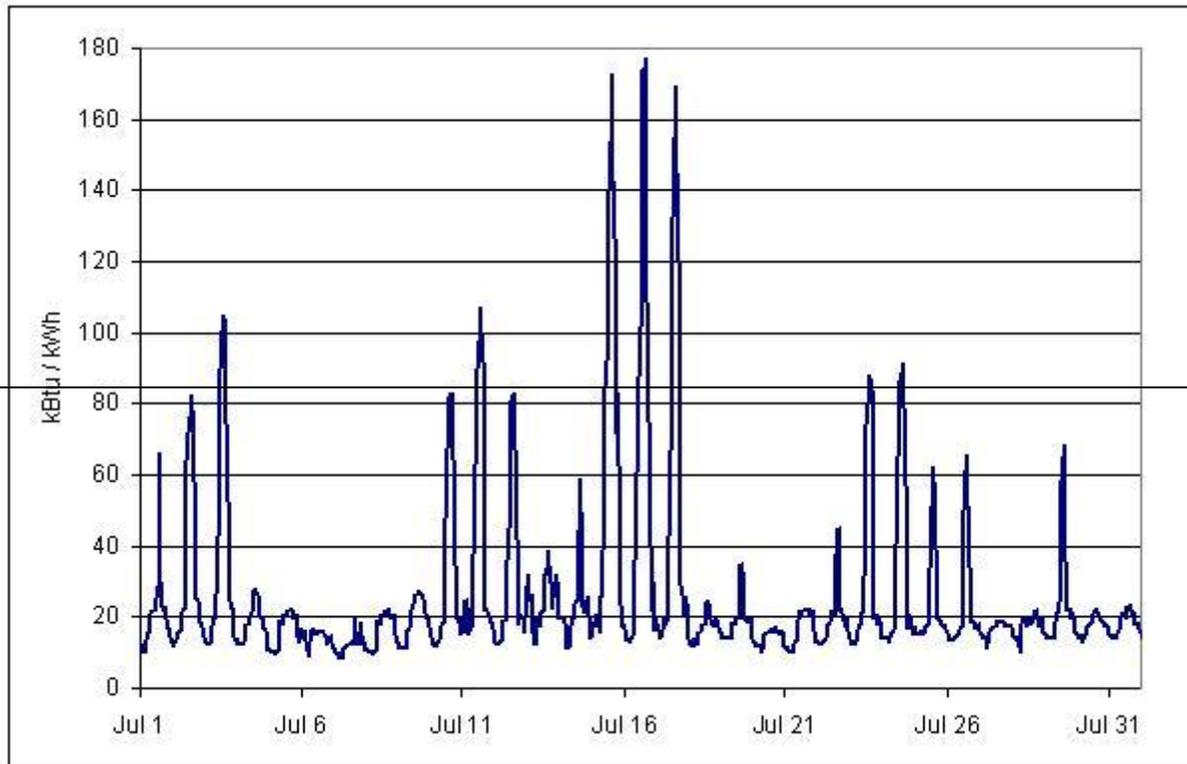


Figure 3-4 – Nonresidential Electricity – Climate Zone 12 – July

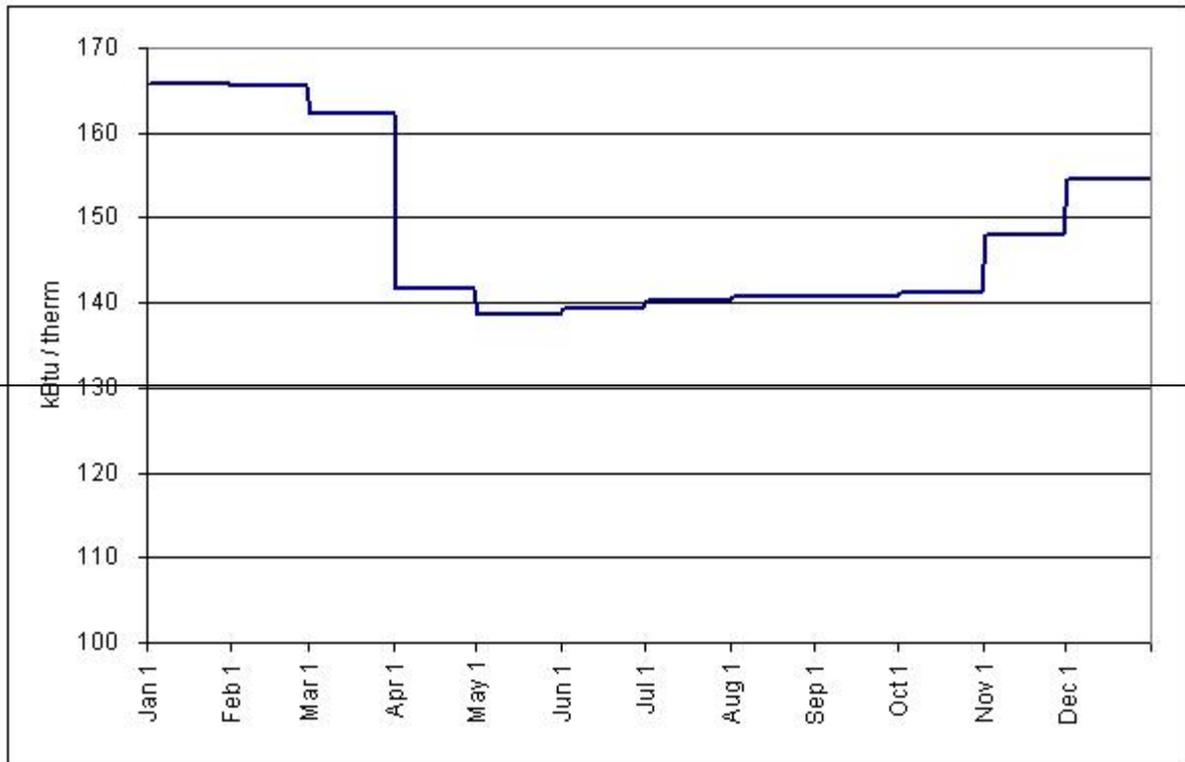


Figure 3-5 Residential Natural Gas Climate Zone 12 Annual

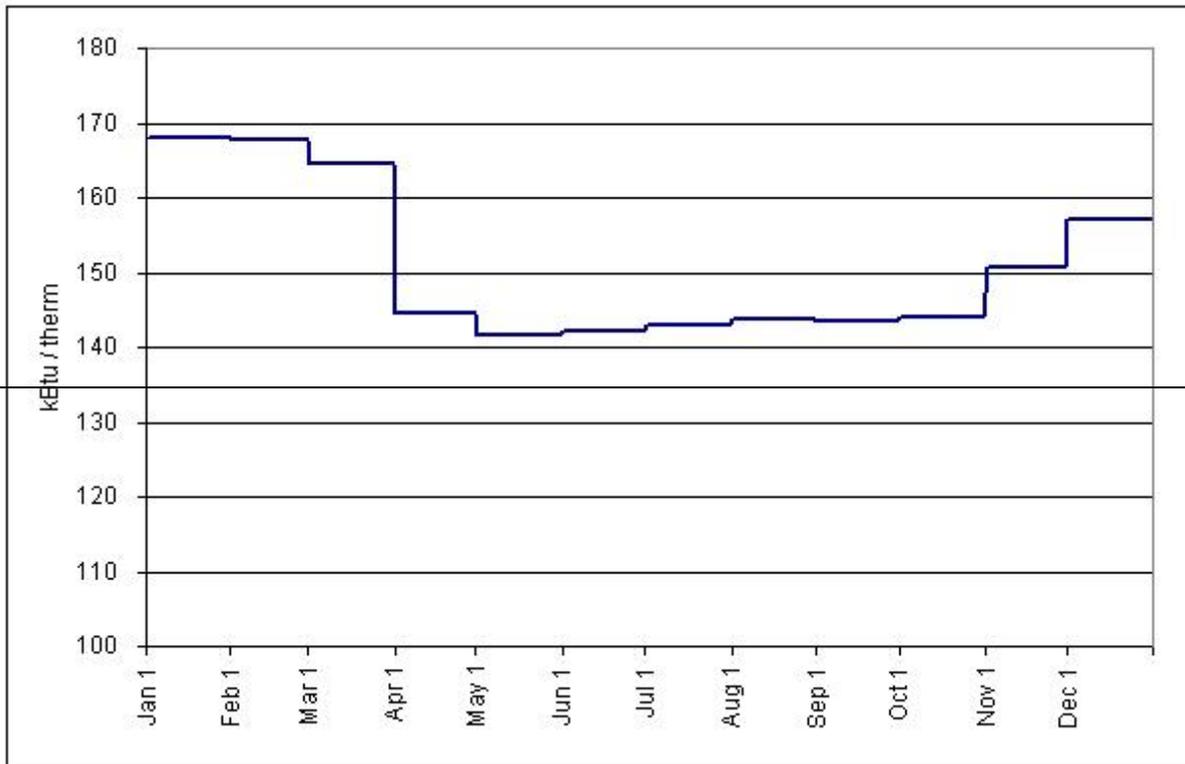


Figure 3-6 – Nonresidential Natural Gas – Climate Zone 12 – Annual

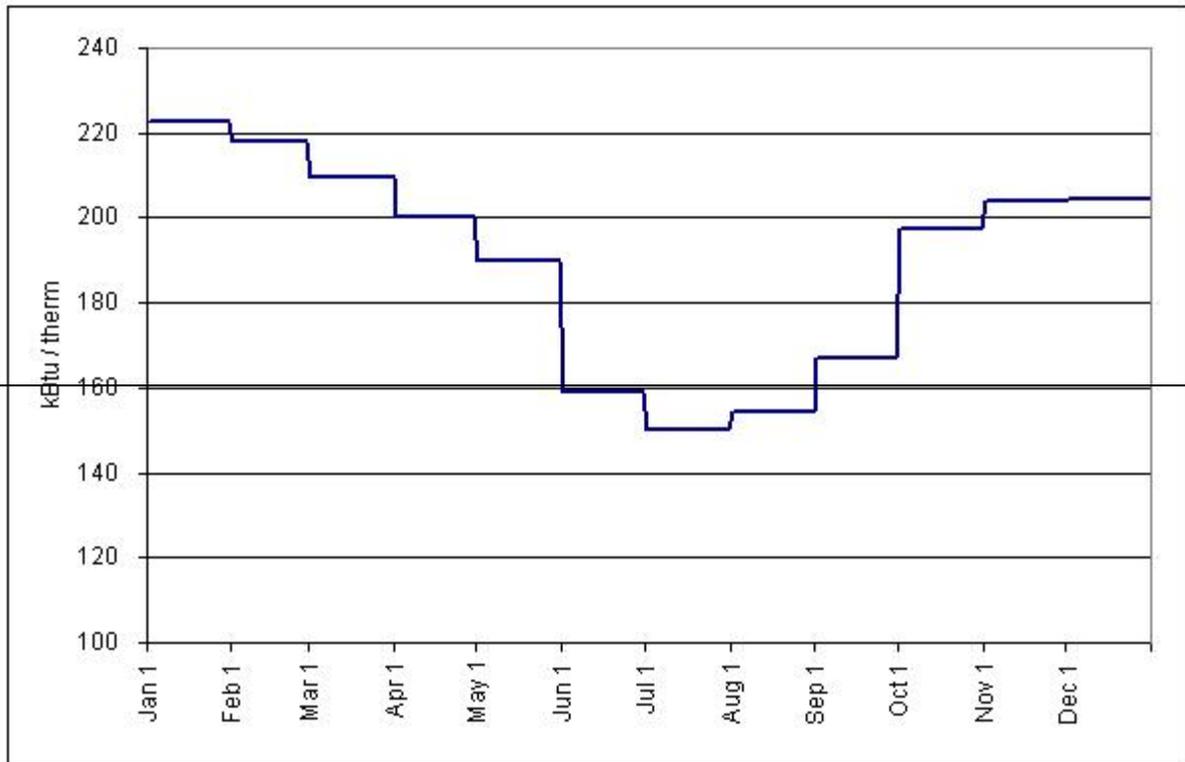


Figure 3-7 Residential Propane Climate Zone 12 Annual

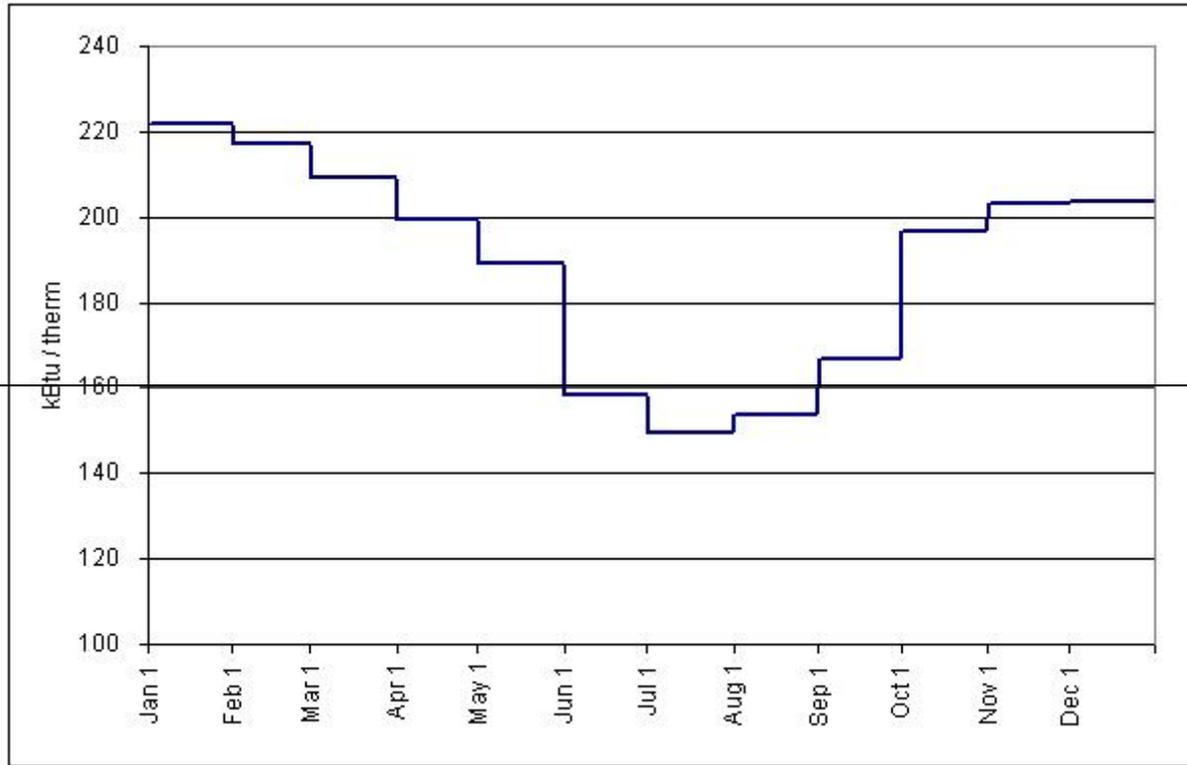


Figure 3-8 – Nonresidential Propane – Climate Zone 12 – Annual

JA3.3 Hourly Emissions Data

Through the development of time dependent valuation hourly data for the 2008 Standards, hourly emissions rates were also determined. Hourly emission rates were not determined by climate zone, but instead by Northern and Southern California regions.

Table 3-4 – Hourly Emissions Summary for Electricity Use

	Climate Zones (6, 7, 8, 9, 10, 15)			Climate Zones (1, 2, 3, 4, 5, 11, 12, 13, 16)		
	lbs/MWh NOx	lbs/MWh PM10	Tons/MWh CO2	lbs/MWh NOx	lbs/MWh PM10	Tons/MWh CO2
Max	0.2746	0.0985	0.8190	0.2746	0.0985	0.8190
Min	0.0544	0.0525	0.3650	0.0544	0.0525	0.3650
Average	0.1030	0.0627	0.4656	0.0993	0.0619	0.4579

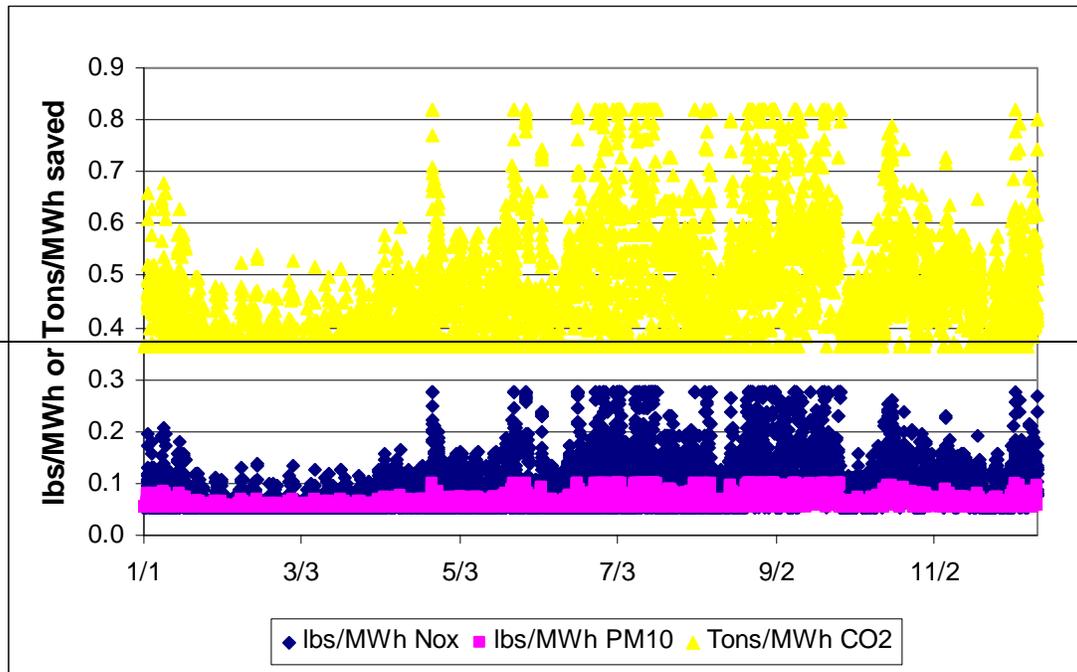


Figure 3-9 — Hourly Emissions Rates for Northern California (CZ 1-5, 11-13, 16)

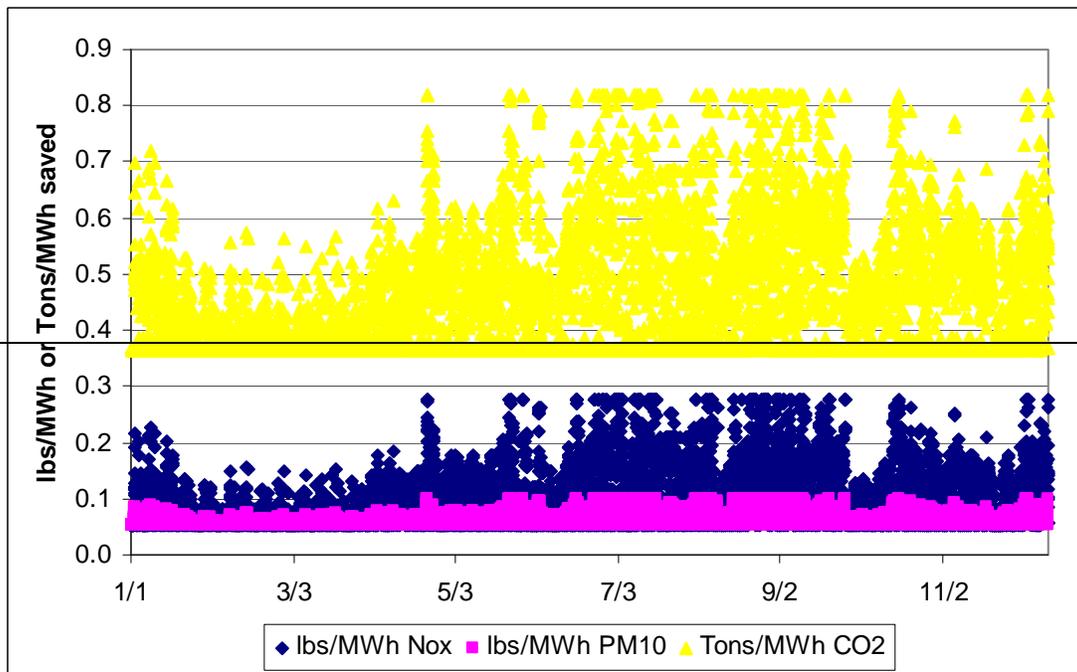


Figure 3-10 — Hourly Emissions Rates for Southern California (CZ 6-10, 15)

Joint Appendix JA4

Appendix JA4 – U-factor, C-factor, and Thermal Mass Data

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4.1 Scope and Purpose

4.1.1 Introduction

The values in this appendix must be used for all residential and nonresidential prescriptive compliance calculations. ~~prescriptive, overall envelope, and whole building performance.~~ California Energy Commission aApproved compliance software may make adjustments to the values in these tables using procedures described in this appendix.

The data tables are organized first by roofs, walls, and floors. For each, the data is further organized by construction type, beginning with wood framed construction, followed by metal framed construction, concrete and special construction assemblies. Each table features a letter/number coordinate system (shaded in gray) that can be used as an identifier for each value, i.e. 4.2.1-A10 indicates Table 4.2.1, Column A, Row 10. Construction assembly descriptions shall be concatenated first by row and then by column. For example, the descriptions of 4.2.1-A20 and 4.3.1-H3 and shall be as follows (abbreviations are acceptable):

Wood Framed Attic, Trusses @ 24 inch OC, R-30 attic insulation, No continuous insulation
Wood Framed Wall, Wd 2x4 @ 16 inch OC, R-13 cavity insulation, R-14 continuous insulation

The R-value representing the component(s) of a construction assembly may be rounded to the nearest whole R-value. If a construction assembly is not adequately represented in the tables below, the permit applicant or the manufacturer of the product may request approval from the California Energy Commission. The California Energy Commission Executive Director will grant such approval, after reviewing submittals from the applicant. New constructions that are approved by the Executive Director will be published as an addendum to this appendix for use by all compliance authors. Addenda may consist of new tables or additional rows or columns to existing tables.

4.1.2 California Energy Commission Approved Software

California Energy Commission approved software used for performance or prescriptive calculations may make adjustments to the data contained in this appendix to account for the special circumstances of particular constructions. This section defines the rules for making these adjustments. These adjustments may not be made when the tables are used manually. Software may have input screens where the user may choose a construction by entering the cavity insulation (or insulation penetrated by framing); the continuous insulation; and other factors such as framing spacing. To the software user, the process of using these tables may look very much like a traditional U-factor calculation.

Determining R-value and U-factor of Construction Assemblies

The installer shall provide documentation from the manufacturer supporting the installed R-value. Some products have R-value markings, others do not. For site applied insulation (i.e., loose-fill glass fiber and mineral fiber, cellulose, and spray polyurethane foam insulation), the insulation shall be installed in conformance to the manufacturer's coverage chart, R-value chart, or similar performance data sheet.

Data presented in the tables is not inclusive of all materials or combinations of materials used in construction of residential and nonresidential buildings. Information presented for framed and nonframed assemblies provides a summary of the reference assembly components representing the R-value and U-factor necessary for determining prescriptive compliance with the Standards. This data is also used by approved compliance software to establish the required thermal efficiencies affecting energy use for the standard design building in performance compliance calculations.

The prescriptive compliance table values for framed and nonframed assemblies of wood and steel roof and ceilings, walls, and floors are developed from series and parallel path procedures of the American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc. (ASHRAE). Approved computer software uses more detailed calculations and must be used for all buildings using mass type construction. Prescriptive compliance can be demonstrated when the insulation's R-value is equal to or greater than the R-value required for the envelope feature in the climate zone which the building is permitted for construction; or has an overall U-factor equal to or less than the U-factor required for the envelope feature in the climate zone which the building is permitted for construction.

The R-value and U-factor of components within assemblies of wood framing that are not represented in the tables can be calculated using the following example (i.e., substituting for different components). For example, R-values of different insulation types can be inserted into Table 4.1.1 and the assembly's overall R-value and U-factor can be determined. Each layer of the assembly is entered in sequence at a cross-section through its cavity, from outside to inside.

For more advanced assemblies, and for steel framed assemblies, the Energy Commission has developed the EZ-FRAME2013 program to automate ASHRAE procedures in order to help the building community in calculating R-values and U-factors of wood and metal framed assemblies with a higher degree of accuracy and speed. The output forms of this program can be used as part of a residential or nonresidential building permit submittal.

Table 4.1.1 U-Factor Calculations for Wood Framed Assembly

<u>Assembly Type: Wall</u>		<u>R-Value</u>	
<u>Framing Material: Wood</u>			
	<u>Assembly Components</u>	<u>Cavity (Rc)</u>	<u>Frame (Rf)</u>
	<u>Outside air film</u>	<u>0.170</u>	<u>0.170</u>
<u>1</u>	<u>0.875 inch stucco</u>		
<u>2</u>	<u>1 inch, R-4 EPS insulating sheathing</u>		
<u>3</u>	<u>Building paper (felt)</u>		
<u>4</u>	<u>R-15 insulation</u>		
<u>5</u>	<u>2x4 inch doug fir framing</u>		
<u>6</u>	<u>0.50 inch gypsum board</u>		
<u>7</u>			
<u>8</u>			
	<u>Inside air film</u>	<u>0.680</u>	<u>0.680</u>
	<u>Subtotal</u>		
		<u>Rc</u>	<u>Rf</u>
	<u>[]</u>	<u>X []</u>	<u>+ []</u>
	<u>1/Rc</u>	<u>1 - (Frame% / 100)</u>	<u>1/Rf</u>
			<u>Frame% / 100</u>
			<u>Assembly U-Factor</u>

$[1/Rc \times 1 - (Frame\% / 100)] + [1/Rf \times Frame\% / 100] = \text{Assembly U-Factor}$
 Where: Frame percentage (%) determined by Table 4.1.6

Accounting for Continuous Insulation R-value

Many of the tables in this appendix have columns for varying levels of continuous insulation. Continuous insulation is insulation that is uninterrupted by framing and provides a continuous insulating layer. Limits on the position of the continuous insulation and other factors are specified in each table. When data from a table is used manually, the R-value of the continuous insulation in the proposed construction shall be equal to or greater than the R-value shown in the column heading; no interpolation is permitted. California Energy Commission approved software used for performance or prescriptive calculations may account for any amount of continuous insulation using Equation 4-1. This adjustment may not be used, however, for continuous insulation with thermal resistance less than R-2.

$$U_{\text{With.Cont.Insul}} = \frac{1}{\frac{1}{U_{\text{Col.A}}} + R_{\text{Cont.Insul}}} \quad \text{Equation 4-1}$$

where

$U_{\text{With.Cont.Insul}}$ Calculated U-factor of the construction assembly with a specific R-value of continuous insulation.

$U_{\text{Col.A}}$ A U-factor selected from column A.

$R_{\text{Cont.Insul}}$ The R-value of continuous insulation.

If insulation layers are added that are interrupted by furring strips, then the effective R-values from Table 4.3.13 shall be used in Equation 4-1.

Accounting for Unusual Construction Layers

The assumptions that are the basis of the U-factors published in this appendix are documented in the paragraphs following each table. California Energy Commission approved software used for prescriptive or performance calculations may be used to make adjustments to these assumptions based on data entered by the software user. Adjustments may only be made, however, when the total R-value of the proposed construction is at least an R-2 greater than the documented assumption. Each table includes the assumptions used to determine the U-factors.

Equation 4-2 shall be used to make these adjustments.

$$U_{\text{Proposed}} = \frac{1}{\frac{1}{U_{\text{With.Cont.Insul}}} + \Delta R_{\text{Assumed}}} \quad \text{Equation 4-2}$$

where

U_{Proposed} Calculated U-factor of the proposed construction assembly.

$U_{\text{With.Cont.Insul}}$ The U-factor adjusted for continuous insulation using Equation 4-1.

$\Delta R_{\text{Assumed}}$ The difference in R-value between what was assumed in the table and the proposed construction for a continuous layer.

There are limits, however, on the types of adjustments that can be made.

- The difference in resistance shall be at least R-2. When calculating the difference in R-value, no changes in assumptions shall be made to the framing/insulation layer; the proposed construction shall assume the same values as the table.
- The thermal resistance of air layers shall be taken from the 2005-2009 ASHRAE Handbook of Fundamentals, for a mean temperature of 50°F, a temperature difference of 20 °F and an effective emittance of 0.82.
- R-values for air layers for roof and ceiling assemblies shall be based on heat flow up. R-values for air layers for floor assemblies shall be based on heat flow down. R-values for other assemblies shall be based on horizontal heat flow. Air layers must be sealed on edges to prevent air layer mixing with ambient air.
- One additional air gap may be credited, but not air gaps that are within the framing insulation cavity layer; these are already accounted for in the published data. Air gaps of less than 0.5 inch thickness shall be considered to have an R-value of zero. An example of an acceptable additional air gap would be the space between a brick veneer and the sheathing on the framed wall.

Double Walls

The U-factor of double walls or other double assemblies may be determined by combining the U-factors from the individual construction assemblies that make up the double wall. The following equation shall be used.

$$U_{\text{Combined}} = \frac{1}{\frac{1}{U_1} + \frac{1}{U_2}} \quad \text{Equation 4-3}$$

4.1.3 Tapered Insulation

If continuous roof insulation is tapered for drainage or other purposes, then the user may determine the overall U-factor in one of two ways:

- To determine the U-factor for the roof at the location where the insulation is at a minimum and where it is at a maximum. Take the average of these two U-factors. With the R-value compliance approach (prescriptive method only), calculate the R-value as the inverse of the average U-factor as determined above. R-values may not be averaged.
- Divide the roof into sub-areas for each one-inch increment of insulation and determine the U-factor of each sub-area. This approach may only be used with the performance method, and in this case, each sub area shall be modeled as a separate surface.

When roofs have a drain located near the center and when tapered insulation creates a slope to the drain, the surface area at the maximum insulation thickness will be significantly greater than the surface area at the minimum thickness, so the second method will give a more accurate result. The first method yields a conservative estimate for roofs with central drains.

4.1.4 Insulating Layers on Mass and Other Walls

The data in Table 4.3.13 may be used to modify the U-factors and C-factors from Table 4.3.5, Table 4.3.6, and Table 4.3.7 when an additional layer is added to the inside or outside of the mass wall. For exterior insulation finish systems (EIFS) or other insulation only systems, values should be selected from row 26 of Table 4.3.13. In these cases, the R-value of the layer is equal to the R-value of the insulation. The other choices from this table represent systems typically placed on the inside of mass walls. The following equations calculate the total U-factor or C-factor, where U_{mass} and C_{mass} are selected from Table 4.3.5, Table 4.3.6, or Table 4.3.7 and R_{Outside} and R_{Inside} are selected from Table 4.3.13. R_{Outside} is selected from row 26 while R_{Inside} is selected from rows 1 through 25.

$$U_{\text{Total}} = \frac{1}{R_{\text{Outside}} + \frac{1}{U_{\text{Mass}}} + R_{\text{Inside}}} \quad \text{Equation 4-4}$$

$$C_{\text{Total}} = \frac{1}{R_{\text{Outside}} + \frac{1}{C_{\text{Mass}}} + R_{\text{Inside}}} \quad \text{Equation 4-5}$$

The values from Table 4.3.13 may be used to modify the U-factors of other construction assemblies as well, when non-homogeneous layers are added (see Equation 4-1).

4.1.5 Wood Based Sheathing R-values

For the purpose of calculations for the Joint Appendices plywood, particle board, oriented strand board (OSB) and similar sheathing materials will all be considered Wood Based Sheathing. A single R-value will be used for each thickness listed regardless of the material. This approach simplifies calculations yet has little effect on the overall R-value of assemblies since the differences in sheathing R-value are minimal compared to the overall assembly.

R-values for Wood Based Sheathing

Thickness	R-value (ft ² -hr °F/Btu)
3/8 inch	0.36
1/2 inch	0.48
5/8 inch	0.60
3/4 inch	0.72
1 inch	0.96
1 1/4 inch	1.20

4.1.6 Framing Percentages for Calculating U-factors

The thermal resistance of framed assemblies is dependent on the assembly's total R-value, and the quality of construction to limit air intrusion within the assembly that can rob the insulation of its effectiveness. A given assembly type is made of several individual components, each having specific resistance values. However, the assembly's R-value and overall U-factor is primarily affected by: (1) the R-value of insulation installed within the cavity, (2) the R-value of insulating sheathing added to the interior or exterior face of the framing, and, (3) the amount of framing that interrupts the plane of insulation separating conditioned from unconditioned space. All framed assemblies shall include the framing percentages indicated in Table 4.1.6.

Advanced wall systems (AWS) reduce the amount of material required for wall framing which increase the insulation within the cavity by:

- Use of 24" oc framing
- Eliminating intermediate framing for cripple and king studs
- Use of single top plates
- Use of double stud corners
- Use of in-line (i.e., stack) framing to maintain continuity of transferring live loads of roof framing to wall framing, allowing roof sheathing and exterior siding to be installed at full widths
- Reduced framing for connections at interior partition walls (i.e., T-walls)
- Reducing window and door header size

Table 4.1.4-6 – Framing Percentages

Assembly Type	Framing Spacing	Framing Percentage
Walls	16"o.c.	25 %
	24"o.c.	22 %
	48"o.c.	4 %
AWS	24" o.c.	17%
Walls Metal	16"o.c.	15%
	24"o.c.	12%
Floors	16"o.c.	10 %
	24"o.c.	7 %
Roofs	16"o.c.	10 %
	24"o.c.	7 %
	48"o.c.	4 %

4.1.7 R-values and U-factors for Medium-Density Closed Cell and Low-Density Open Cell Spray Polyurethane Foam (SPF) Insulation:

Medium Density Closed Cell and Light Density Open Cell

These procedures apply to two types of SPF used as building insulation: medium-density closed cell SPF (ccSPF) and low-density open cell SPF (ocSPF).

(a) (a) -ccSPF: A spray applied polyurethane foam insulation having a closed cellular structure resulting in an installed nominal density of 1.5 to less than 2.5 pounds per cubic foot (pcf).

(b) —R-value: The total R-value shall be calculated based on the nominal required thickness of the insulation multiplied by an R-value of 5.8 per inch. Alternatively, the total R-value may be calculated based on the thickness of insulation multiplied by the "tested R-value per inch" as listed in the Table of R-values or R-value Chart from the manufacturer's current ICC Evaluation Service Report (ESR) that shows compliance with Acceptance Criteria for Spray-Applied Foam Plastic Insulation--AC377.

Based on this calculation, the overall assembly U-factor shall be determined by selecting the assembly that matches the assembly type, framing configuration, and cavity insulation from the appropriate Reference Joint Appendix JA4 table. The R-value of ccSPF insulation shall meet or exceed the installed thickness specified in Table 4.1.7.

The R-value of the installed insulation shall be based on the verified thickness at an R-value of 5.8 per inch unless an ESR is provided with compliance documentation that verifies use of other values. Approved compliance software shall make appropriate adjustments to account for the R-value and U-factor effects of the ccSPF assembly.

Nominal Thickness: ccSPF sprayed into framed cavities or on flat surfaces will expand with variable thicknesses, visibly appearing as undulations on the surface of the insulation. The average thickness of the foam insulation must meet or exceed the required R-value. Depressions in the foam insulation's surface shall not be greater than 1/2-inch of the required thickness at any given point of the surface area being insulated.

Filling of Framed Assemblies: ccSPF insulation is not required to fill the cavities of framed assemblies provided the installed thickness of insulation conforms to compliance documentation and that the bottom and top plates of vertical framing and both ends of horizontal framing, including band and rim joists, are sprayed to completely fill the cavity adjacent to and in contact with the framing to a distance of 2.0 inches away from the framing for ocSPF insulation, or filled to the thickness meeting ASTM testing as an air barrier.

Air Barrier: ccSPF installed as an air barrier shall be a minimum of 2.0 inches in thickness; alternatively, ccSPF insulation shall be installed at a thickness that meets an air permeance no greater than 0.02 L/s-m^2 at 75 Pa pressure differential when tested in accordance to ASTM E2178 or ASTM E283.

(b) ocSPF: A spray applied polyurethane foam insulation having an open cellular structure resulting in an installed nominal density of 0.4 to less than 1.5 pounds per cubic foot (pcf).

R-value: The total R-value shall be calculated based on the nominal required thickness of the insulation multiplied by an R-value of 3.6 per inch. Alternatively, the total R-value may be calculated based on the thickness of insulation multiplied by the "tested R-value per inch" as listed in the Table of R-values or R-value Chart from the manufacturer's current ICC Evaluation Service Report (ESR) that shows compliance with *Acceptance Criteria for Spray-Applied Foam Plastic Insulation--AC377*.

Based on this calculation, the overall assembly U-factor shall be determined by selecting the assembly that matches the assembly type, framing configuration, and cavity insulation from the appropriate Reference Joint Appendix JA4 table. The R-value of ocSPF insulation shall meet or exceed the installed thickness specified in Table 4.1.7.

The R-value of the installed insulation shall be based on the verified thickness at an R-value of 3.6 per inch unless an ESR is provided with compliance documentation that verifies use of other values. Approved compliance software shall make appropriate adjustments to account for the R-value and U-factor effects of the ocSPF assembly.

Nominal Thickness: ocSPF sprayed into framed cavities or on flat surfaces will expand with variable thicknesses, visibly appearing as undulations on the surface of the insulation. The average thickness of the foam insulation must meet or exceed the required R-value. Depressions in the foam insulation surface shall not be greater than 1-inch of the required thickness provided these depressions do not exceed 10% of the surface area being insulated.

Filling of Framed Assemblies: ocSPF insulation shall completely fill cavities of 2x4 inch framing or less. Cavities greater than 2x4 inch framing dimensions may be filled to the thickness that meets the required R-value used for compliance provided that the bottom and top plates of vertical framing and both ends of horizontal framing, including band and rim joists, are sprayed to completely fill the cavity adjacent to and in contact with the framing to a distance of 5.5 inches away from the framing for ocSPF insulation, or filled to the thickness meeting ASTM testing as an air barrier.

Air Barrier: ocSPF installed as an air barrier shall be a minimum of 5.5 inches in thickness; alternatively, ocSPF insulation shall be installed at a thickness that meets an air permeance no greater than 0.02 L/s-m^2 at 75 Pa pressure differential when tested in accordance to ASTM E2178 or ASTM E283.

Table 4.1.7: Required Thickness of SPF Insulation (inches) to Achieve Specified R-values

<u>Equivalent R-Values for SPF insulation</u>	<u>11</u>	<u>13</u>	<u>15</u>	<u>19</u>	<u>21</u>	<u>22</u>	<u>25</u>	<u>30</u>	<u>38</u>
<u>Required thickness of ccSPF Insulation @ R5.3/inch</u>	<u>2.00</u>	<u>2.25</u>	<u>2.75</u>	<u>3.50</u>	<u>3.75</u>	<u>4.00</u>	<u>4.50</u>	<u>5.25</u>	<u>6.75</u>
<u>Required thickness of ocSPF insulation @ R3.6/inch</u>	<u>3.0</u>	<u>3.5</u>	<u>4.2</u>	<u>5.3</u>	<u>5.8</u>	<u>6.1</u>	<u>6.9</u>	<u>8.3</u>	<u>10.6</u>

NOTE:

A HERS rater shall verify the installation of SPF insulation using the procedures specified in RA3.5.5 whenever R-values other than the default R-value per inch listed in Table 4.1.7 are used for compliance (see "R-value" in sections RA3.5.5.0.1(a) and RA3.5.5.0.1(b)).

4.2 Roofs and Ceilings

Table 4.2.1 – U-factors of Wood Framed Attic Roofs

Truss Spacing	R-value of Attic Insulation		Rated R-value of Continuous Insulation ¹							
			None	R-2	R-4	R-6	R-7	R-8	R-10	R-14
			A	B	C	D	E	F	G	H
16 in. OC	None	1	0.300	0.187	0.136	0.107	0.097	0.088	0.075	0.058
	R-11	2	0.079	0.068	0.060	0.053	0.051	0.048	0.044	0.037
	R-13	3	0.071	0.062	0.055	0.050	0.047	0.045	0.041	0.036
	R-19	4	0.049	0.045	0.041	0.038	0.037	0.035	0.033	0.029
	R-21	5	0.042	0.039	0.036	0.034	0.032	0.031	0.030	0.026
	R-22	6	0.043	0.039	0.037	0.034	0.033	0.032	0.030	0.027
	R-25	7	0.038	0.035	0.033	0.031	0.030	0.029	0.028	0.025
	R-30	8	0.032	0.030	0.028	0.027	0.026	0.025	0.024	0.022
	R-38	9	0.026	0.024	0.023	0.022	0.022	0.021	0.020	0.019
	R-44	10	0.021	0.020	0.019	0.019	0.018	0.018	0.017	0.016
	R-49	11	0.020	0.019	0.019	0.018	0.018	0.017	0.017	0.016
	R-60	12	0.017	0.016	0.016	0.015	0.015	0.015	0.014	0.013
24 in. OC	None	13	0.305	0.189	0.137	0.108	0.097	0.089	0.075	0.058
	R-11	14	0.076	0.066	0.058	0.052	0.050	0.047	0.043	0.037
	R-13	15	0.068	0.060	0.054	0.048	0.046	0.044	0.041	0.035
	R-19	16	0.048	0.043	0.040	0.037	0.036	0.034	0.032	0.029
	R-21	17	0.043	0.040	0.037	0.034	0.033	0.032	0.030	0.027
	R-22	18	0.041	0.038	0.036	0.033	0.032	0.031	0.029	0.026
	R-25	19	0.037	0.034	0.032	0.030	0.029	0.028	0.027	0.024
	R-30	20	0.031	0.029	0.028	0.026	0.025	0.025	0.024	0.022
	R-38	21	0.025	0.024	0.023	0.022	0.021	0.021	0.020	0.018
	R-44	22	0.021	0.020	0.019	0.019	0.018	0.018	0.017	0.016
	R-49	23	0.019	0.019	0.018	0.017	0.017	0.017	0.016	0.015
	R-60	24	0.016	0.016	0.015	0.015	0.014	0.014	0.014	0.013

Notes:

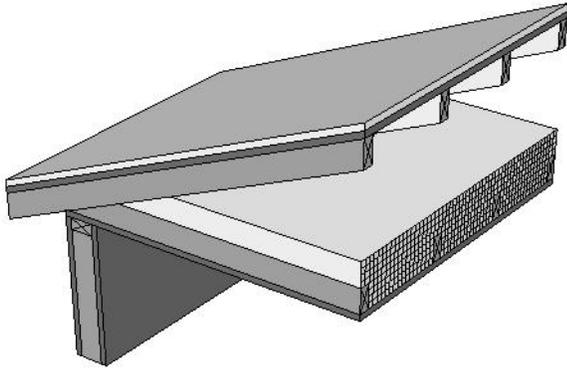
1. Continuous insulation shall be located at the ceiling, below the bottom chord of the truss and be uninterrupted by framing.
2. In climate zones 1 and 16 the insulating R-value of continuous insulation materials installed above the roofs waterproof membrane shall be multiplied by 0.8 before choosing the table column for determining assembly U-factor.

This table contains thermal performance data (U-factors) for wood framed attics where the ceiling provides the air barrier and the attic is ventilated. Wood trusses are the most common construction for low-rise residential buildings and for Type V nonresidential buildings. While the sketch shows a truss system with a flat ceiling, the data in this table may be used for scissor trusses and other non-flat trusses. If the bottom chord is not flat, then the slope should not exceed 4:12 for nonadhesive binder blown insulation. This table may also be used with composite trusses that have a wood top and bottom chord and metal struts connecting them.

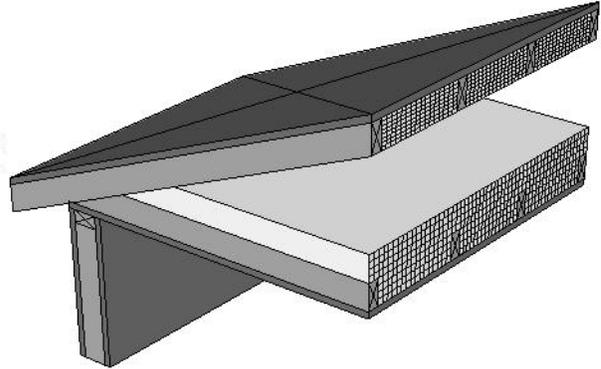
For the majority of cases, values will be selected from column A of this table. Column A shall be used for the common situation where either batt or blown insulation is placed directly over the ceiling (and tapered at the edges). Builders or designers may increase thermal performance by adding a continuous insulation layer at the ceiling. The continuous insulation is typically a rigid polystyrene or polyisocyanurate foam insulation. Continuous insulation does not include the blown or batt insulation that is over the bottom chord of the truss (this is already accounted for in the U-factors published in Column A).

When this table is used manually, the R-value of continuous insulation shall be equal to or greater than the R-value published in the continuous insulation columns. For instance if the insulation is R-3, the R-2 column shall be used. No interpolation is permitted when data from the table is selected manually. CEC approved compliance software, including those used for prescriptive compliance, may accurately account for any amount of continuous insulation or for unusual construction assemblies using Equation 4-1 and Equation 4-2.

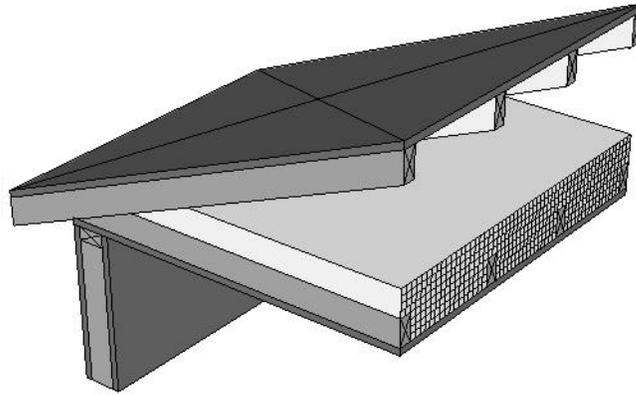
Insulation Above Deck



Insulation Below Deck



No Deck Insulation



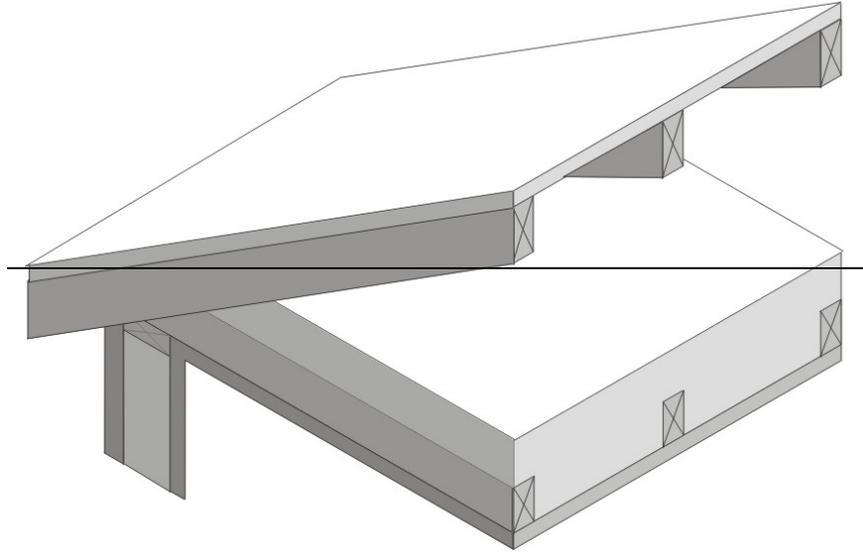


Figure 4.2.24 – Wood Framed Attic Roofs

This table shall not be used for cases where insulation is located at the roof of the attic. There are two situations where this may be done. Foamed plastic may be sprayed onto the top chord of the trusses and onto the bottom of the upper structural deck (roof). The foam expands and cures to provide an airtight barrier and continuous insulation. Another case is where a plastic membrane or netting is installed above the ceiling, (hanging below the roof deck) and either batt or blown insulation is installed over the netting. In both of these cases, the attic is sealed (not ventilated). There are a number of issues related to these insulation techniques and special CEC approval is required.

Assumptions: These data are calculated using the parallel path method documented in the 2005-2009 ASHRAE Handbook of Fundamentals. These calculations assume an exterior air film of R-0.17, asphalt shingles of R-0.44 (AR02), building paper of R-0.06 (BP01), ½ inch of wood based sheathing (Custom), an attic air space (greater than 3.5 inch) with a R-0.80, the insulation / framing layer, continuous insulation (if any) 1/2 inch gypsum board (GP01) of R-0.45, and an interior air film (heat flow up) of R-0.61. Wood 2x4 framing is assumed at the ceiling level. R-13 of attic insulation is assumed between the framing members; above that level, attic insulation is uninterrupted by framing. The framing percentage is assumed to be 10 percent for 16 inch on center and 7 percent for 24 inch on center. 7.25 percent of the attic insulation above the framing members is assumed to be at half depth, due to decreased depth of insulation at the eaves.

Table 4.2.2 – U-factors of Wood Framed Rafter Roofs

Rafter Spacing	R-value of Cavity Insulation	Nominal Framing Size	Rated R-value of Continuous Insulation ^{5,6}								
			None	R-2	R-4	R-6	R-7	R-8	R-10	R-14	
			A	B	C	D	E	F	G	H	
16 in. OC	None	Any	1	0.297	0.186	0.136	0.107	0.096	0.088	0.075	0.058
	R-11 ²	2x4	2	0.084	0.072	0.063	0.056	0.053	0.050	0.046	0.039
	R-13 ²	2x4	3	0.075	0.065	0.058	0.052	0.049	0.047	0.043	0.037
	R-15 ²	2x4	4	0.068	0.060	0.053	0.048	0.046	0.044	0.040	0.035
	R-19 ²	2x4	5	0.075	0.065	0.058	0.052	0.049	0.047	0.043	0.037
	R-19 ^{2,3}	2x4	6	0.062	0.055	0.050	0.045	0.043	0.041	0.038	0.033
	R-11	2x6	7	0.076	0.066	0.058	0.052	0.050	0.047	0.043	0.037
	R-13	2x6	8	0.069	0.061	0.054	0.049	0.047	0.044	0.041	0.035
	R-15	2x6	9	0.062	0.055	0.050	0.045	0.043	0.041	0.038	0.033
	R-19 ²	2x6	10	0.056	0.050	0.046	0.042	0.040	0.039	0.036	0.031
	R-21 ²	2x6	11	0.052	0.047	0.043	0.040	0.038	0.037	0.034	0.030
	R-19 ²	2x8	12	0.051	0.046	0.042	0.039	0.038	0.036	0.034	0.030
	R-21	2x8	13	0.048	0.044	0.040	0.037	0.036	0.035	0.032	0.029
	R-22	2x10	14	0.044	0.040	0.037	0.035	0.034	0.033	0.031	0.027
	R-25	2x10	15	0.041	0.038	0.035	0.033	0.032	0.031	0.029	0.026
	R-30 ⁴	2x10	16	0.036	0.034	0.031	0.030	0.029	0.028	0.026	0.024
	R-30	2x12	17	0.035	0.033	0.031	0.029	0.028	0.027	0.026	0.023
	R-38 ⁴	2x12	18	0.029	0.027	0.026	0.025	0.024	0.024	0.022	0.021
	R-38 ⁴	2x14	19	0.028	0.027	0.025	0.024	0.023	0.023	0.022	0.020
	Sprayed Foam or Cellulose Insulation ^{2,5}	2x4	20								
				0.074	0.064	0.057	0.051	0.049	0.046	0.043	0.036
2x6		21		0.062	0.047	0.043	0.040	0.038	0.037	0.034	0.030
2x8		22		0.041	0.038	0.035	0.033	0.032	0.031	0.029	0.026
2x10		23		0.033	0.031	0.029	0.028	0.027	0.026	0.025	0.023
2x12	24		0.028	0.027	0.025	0.024	0.023	0.023	0.022	0.020	
24 in. OC	None	Any	25	0.237	0.161	0.122	0.098	0.089	0.082	0.070	0.055
	R-11 ²	2x4	26	0.081	0.070	0.061	0.055	0.052	0.049	0.045	0.038
	R-13 ²	2x4	27	0.072	0.063	0.056	0.050	0.048	0.046	0.042	0.036
	R-15 ²	2x4	28	0.065	0.058	0.052	0.047	0.045	0.043	0.039	0.034
	R-19 ²	2x4	29	0.072	0.063	0.056	0.050	0.048	0.046	0.042	0.036
	R-19 ^{2,3}	2x4	30	0.059	0.053	0.048	0.044	0.042	0.040	0.037	0.032
	R-11	2x6	31	0.075	0.065	0.058	0.052	0.049	0.047	0.043	0.037
	R-13	2x6	32	0.067	0.059	0.053	0.048	0.046	0.044	0.040	0.035
	R-15 ²	2x6	33	0.060	0.054	0.048	0.044	0.042	0.041	0.038	0.033
	R-19 ²	2x6	34	0.054	0.049	0.044	0.041	0.039	0.038	0.035	0.031
	R-21 ²	2x6	35	0.049	0.045	0.041	0.038	0.036	0.035	0.033	0.029
	R-19 ²	2x8	36	0.049	0.045	0.041	0.038	0.036	0.035	0.033	0.029
	R-21	2x8	37	0.046	0.042	0.039	0.036	0.035	0.034	0.032	0.028
	R-22	2x10	38	0.043	0.040	0.037	0.034	0.033	0.032	0.030	0.027
	R-25	2x10	39	0.039	0.036	0.034	0.032	0.031	0.030	0.028	0.025
	R-30 ⁴	2x10	40	0.034	0.032	0.030	0.028	0.027	0.027	0.025	0.023

R-30	2x12	41	0.033	0.031	0.029	0.028	0.027	0.026	0.025	0.023
R-38 ⁴	2x12	42	0.028	0.027	0.025	0.024	0.023	0.023	0.022	0.020
R-38 ⁴	2x14	43	0.027	0.026	0.024	0.023	0.023	0.022	0.021	0.020
Sprayed Foam or Cellulose Insulation ^{2,5}	2x4	44								
			0.071	0.062	0.055	0.050	0.047	0.045	0.042	0.036
	2x6	45	0.050	0.045	0.042	0.038	0.037	0.036	0.033	0.029
	2x8	46	0.039	0.036	0.034	0.032	0.031	0.030	0.028	0.025
	2x10	47	0.032	0.030	0.028	0.027	0.026	0.025	0.024	0.022
	2x12	48	0.026	0.025	0.024	0.022	0.022	0.022	0.021	0.019

Notes:

1. Rigid foam board used for cavity insulation must fill the entire cavity between the rafters and be sealed properly to prevent air gaps, and must be secured properly to prevent any future discrepancies in the construction assembly.
2. This assembly is only allowed where ventilation is provided between the bottom of the roof deck and the top of the insulation meeting CBC requirements or with enforcement agency officials approval of rafter attic assemblies with no ventilation air spaces.
3. This assembly requires insulation with an R-value per inch 5.6 or larger (k-factor 1.8 or less). This is board type insulation, mostly Isocyanurate. Medium density spray polyurethane foam may also be used to meet this requirement if the quality installation procedures and documentation in Reference Joint Appendix JA7 are followed, Documentation from Directory of Certified insulation materials must be provided to show compliance with this assembly.
4. Higher density fiberglass batt is needed to achieve the indicated U-factor. R-30 must be achieved with less than 8.25 inch full thickness. R-38 must be achieved with less than 10.25 inch thickness (R-30c, R-38c).
5. ~~Foamed plastic or cellulose insulation shall fill the entire cavity. Cellulose shall have a binder to prevent sagging. Verify that the building official in your area permits this construction, since there is no ventilation layer.~~
6. Continuous insulation shall be located at the ceiling or at the roof and be uninterrupted by framing . In climate zones 1 and 16 the insulating R-value of continuous insulation materials installed above the roofs waterproof membrane shall be multiplied by 0.8 before choosing the table column for determining assembly U-factor.

This table contains thermal performance data (U-factors) for wood framed rafter roofs. This is a common construction in low-rise residential buildings and in Type V nonresidential buildings. The rafters may be either flat or in a sloped application. Insulation is typically installed between the rafters. With this construction, the insulation is in contact with the ceiling and there is typically a one-inch air gap above the insulation so that moisture can be vented. Whether there is a 1-inch air space above the insulation depends on local climate conditions and may not be required in some building permit jurisdictions. ~~The ventilation space requirement would have to be waived by the building official for the case of cellulose insulation or foamed plastic, since the entire cavity would be filled.~~ Filling the entire cavity of framed rafter assemblies with loose-fill mineral fiber and wool, cellulose, or ccSPF requires prior approval by the local building official.

For the majority of cases, U-factors will be selected from Column A of this table; this case covers insulation placed only in the cavity. When continuous insulation is installed either at the ceiling or at the roof, then U-factors from other columns may be selected. The continuous insulation is typically a rigid polystyrene or polyisocyanurate foam insulation, but can also include mineral wool or other suitable materials.

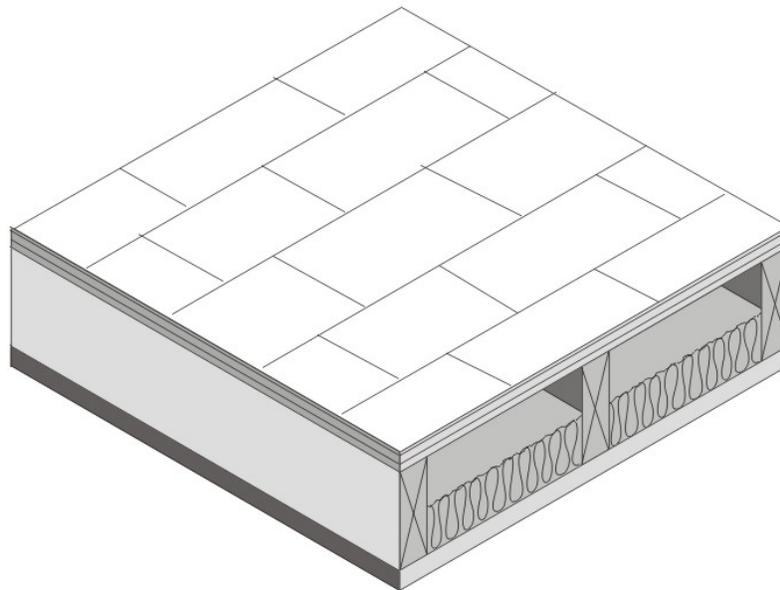


Figure 4.2.32 – Wood Frame Rafter Roof

When this table is used manually, the R-value of continuous insulation shall be equal to or greater than the R-value published in the continuous insulation columns. For instance if the continuous insulation is R-3, the R-2 column shall be used. No interpolation is permitted when data from the table is used manually. CEC approved software, however, may determine the U-factor for any amount of continuous insulation and/or for layers using Equation 4-1 and Equation 4-2.

Assumptions: These data are calculated using the parallel path method documented in the 2005-2009 ASHRAE Handbook of Fundamentals. These calculations assume an exterior air film of R-0.17, asphalt shingles of R-0.44 (AR02), building paper of R-0.06 (BP01), 1/2 inch of wood based sheathing (Custom), continuous insulation (optional), the insulation / framing layer with an air space of R-0.76 or R-0.80 (except for loose-fill mineral fiber and wool, cellulose, ccSPF, and ccSPF foamed plastic), 1/2 inch gypsum of R-0.45 (GP01), and an interior air film (heat flow up diagonally) of R-0.62. The continuous insulation may also be located at the ceiling, between the drywall and the framing. The framing percentage is assumed to be 10 percent for 16 inch OC and 7 percent for 24 inch. OC. The thickness of framing members is assumed to be the actual size of 3.50, 5.50, 7.25, 9.25, and 11.25 inches for 2x4, 2x6, 2x8, 2x10, and 2x12 nominal sizes. High-density batt insulation is assumed to be 8.5 inch thick for R-30 and 10.5 inch thick for R-38. The R-value of sprayed foam and cellulose insulation is assumed to be R-3.6 per inch.

Wood Framing Connection Type (spline)	Insulation Core R-value ¹	Typical Panel Thickness		Rated R-value of Continuous Insulation ^{4,5}		
				None	R-2	R-4
				A	B	C
OSB	R-21.7	6.5 in	1	0.041	0.038	0.035
Single 2x	R-22.7	6.5 in	2	0.044	0.040	0.037
Double 2x	R-24.7	6.5 in	3	0.046	0.042	0.038
I-joist	R-24.7	6.5 in	4	0.043	0.039	0.036
OSB	R-28.4	8.25 in	5	0.033	0.031	0.029
Single 2x	R-28.4	8.25 in	6	0.034	0.032	0.030
Double 2x	R-28.4	8.25 in	7	0.037	0.034	0.031
I-joist	R-28.4	8.25 in	8	0.033	0.310	0.029
OSB	R-33.2 ²	6.5 in	9	0.030	0.027	0.026
Single 2x	R-33.2 ²	6.5 in	10	0.031	0.029	0.027
Double 2x	R-33.2 ²	6.5 in	11	0.034	0.031	0.029
I-joist	R-33.2 ²	6.5 in	12	0.031	0.028	0.027
OSB	R-36.4	10.25 in	13	0.026	0.025	0.024
Single 2x	R-36.4	10.25 in	14	0.028	0.026	0.025
Double 2x	R-36.4	10.25 in	15	0.029	0.028	0.026
I-joist	R-36.4	10.25 in	16	0.027	0.025	0.024
OSB	R-44.8	12.25 in	17	0.021	0.020	0.019
Single 2x	R-44.8	12.25 in	18	0.023	0.022	0.021
Double 2x	R-44.8	12.25 in	19	0.025	0.023	0.022
I-joist	R-44.8	12.25 in	20	0.022	0.021	0.020
OSB	R-55.3 ³	10.25 in	21	0.017	0.016	0.016
Single 2x	R-55.3 ³	10.25 in	22	0.019	0.018	0.018
Double 2x	R-55.3 ³	10.25 in	23	0.021	0.020	0.019
I-joist	R-55.3 ³	10.25 in	24	0.018	0.017	0.017
Steel Framing	R-14	48 in	25	0.075	0.065	0.058
	R-22	48 in	26	0.057	0.051	0.046
	R-28	48 in	27	0.047	0.043	0.040
	R-36	48 in	28	0.043	0.040	0.037

NOTES:

1. The insulation R-value must be at least R-21.7 in order to use this table. This table assumes moulded expanded polystyrene (EPS) unless noted otherwise. Although other insulation types are used by some SIP manufacturers, such as polyurethane and extruded expanded insulation (XPS), EPS is the most common insulation used in SIP construction.
2. R-33.2 is achievable using polyurethane insulation in 6.5" panels.
3. R-55.3 is achievable using polyurethane insulation in 10.25" panels.
4. Continuous insulation shall be at least R-2 and may be installed on either the inside or the exterior of the roof/ceiling.
5. In climate zones 1 and 16 the insulating R-value of continuous insulation materials installed above the roof waterproof membrane shall be multiplied times 0.8 before choosing the table column for determining assembly U-factor.

Table 4.2.3 – U-factors of Structurally Insulated Panels (SIPS) Roof/Ceilings

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Structural insulated panels (SIPs) consist of a rigid insulation core, securely bonded between two structural facings, to form a structural sandwich panel. SIPs are considered a non-framed assembly usually with little or no structural framing that penetrates the insulation layer, resulting in less thermal bridging across the insulation when compared to a conventional framed assembly.

This table gives U-factors for structurally insulated panels used in ceiling and roof constructions. ~~This is a construction system that consists of rigid foam insulation sandwiched between two layers of plywood or oriented strand board (OSB).~~ Data is provided for three variations of this system. The system labeled "Wood Framing" uses wood spacers to separate the plywood or OSB boards and provide a means to connect the panels with mechanical fasteners. The system labeled "Steel Framing" uses steel framing members and mechanical fasteners at the joints. The system labeled "OSB Spline" uses splines to connect the panels so that framing members do not penetrate the insulation.

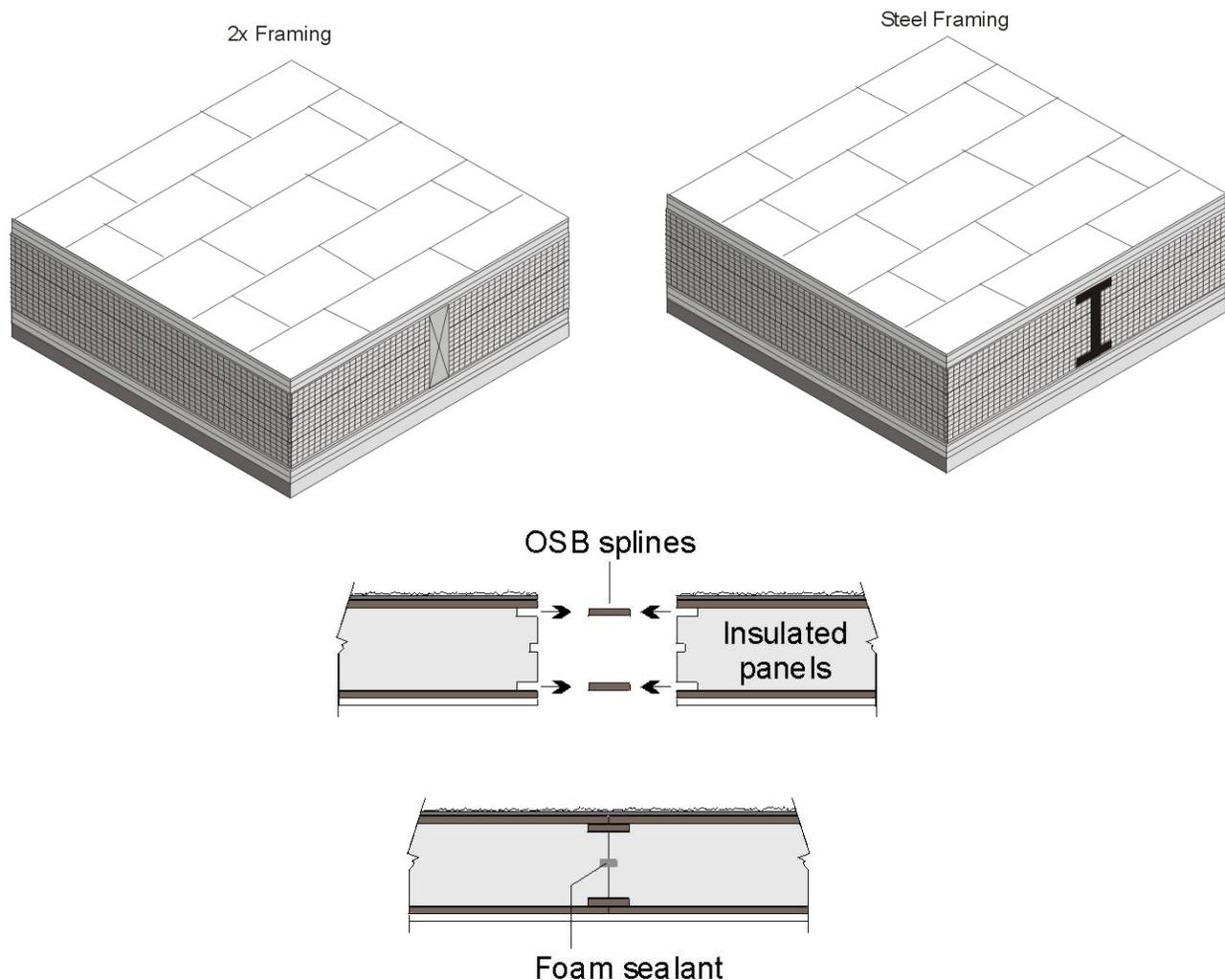


Figure 4.2.43 – SIPS Roof/Ceiling

Data from Column A will be used in most cases, since it is quite unusual to add continuous insulation to a panel that is basically all insulation anyway. If insulation is added, however, then the U-factor is selected from one of the other columns. If the tables are used manually, then the installed insulation shall have a thermal resistance at least as great as the column selected. When the table is used with CEC approved compliance software, then the R-value of any amount of continuous insulation may be accounted for along with the thermal resistance of special construction layers may be accounted for using Equation 4-1 and Equation 4-2.

Assumptions: The wood framing and OSB spline data are calculated using the parallel path method documented in the 2005-2009 ASHRAE Handbook of Fundamentals. Assemblies with metal framing are calculated using the ASHRAE Zone Calculation Method which is also documented in the 2005 ASHRAE Handbook of Fundamentals. These calculations assume an exterior air film of R-0.17, asphalt shingles of R-0.44 (AR02), building paper of R-0.06 (BP01), 7/16 inch of OSB of R-0.69, the rigid insulation of R-3.85 per inch, another layer of 7/16 inch of OSB, ½ inch gypsum board of R-0.45 (GP01), an R-value of 0.99 per inch is assumed for the wood frame and an interior air film (heat flow up diagonally) of R-0.62. If an additional layer of insulation is used, this may be installed on either the interior or exterior of the SIPS panel assembly.

Table 4.2.4 – U-factors of Metal Framed Attic Roofs

Spacing	Nominal Framing Size	Cavity Insulation R-Value:	Rated R-value of Continuous Insulation ¹								
			R-0	R-2	R-4	R-6	R-7	R-8	R-10	R-14	
			A	B	C	D	E	F	G	H	
16 in. OC	Any	None	1	0.328	0.198	0.142	0.111	0.100	0.091	0.077	0.059
	2 x 4 (3.65 in.)	R-11	2	0.126	0.101	0.084	0.072	0.067	0.063	0.056	0.046
		R-13	3	0.121	0.097	0.082	0.070	0.066	0.061	0.055	0.045
		R-19	4	0.071	0.062	0.055	0.050	0.047	0.045	0.042	0.036
		R-21	5	0.063	0.056	0.050	0.046	0.044	0.042	0.039	0.033
		R-22	6	0.059	0.053	0.048	0.044	0.042	0.040	0.037	0.032
		R-25	7	0.051	0.046	0.042	0.039	0.038	0.036	0.034	0.030
		R-30	8	0.041	0.038	0.035	0.033	0.032	0.031	0.029	0.026
		R-38	9	0.031	0.029	0.028	0.026	0.025	0.025	0.024	0.022
		R-44	10	0.027	0.026	0.024	0.023	0.023	0.022	0.021	0.020
		R-49	11	0.024	0.023	0.022	0.021	0.021	0.020	0.019	0.018
	R-60	12	0.019	0.018	0.018	0.017	0.017	0.016	0.016	0.015	
24 in. OC	Any	None	13	0.324	0.197	0.141	0.110	0.099	0.090	0.076	0.059
	2 x 4 (3.65 in.)	R-11	14	0.109	0.089	0.076	0.066	0.062	0.058	0.052	0.043
		R-13	15	0.103	0.085	0.073	0.064	0.060	0.056	0.051	0.042
		R-19	16	0.065	0.058	0.052	0.047	0.045	0.043	0.039	0.034
		R-21	17	0.058	0.052	0.047	0.043	0.041	0.040	0.037	0.032
		R-22	18	0.055	0.050	0.045	0.041	0.040	0.038	0.035	0.031
		R-25	19	0.047	0.043	0.040	0.037	0.035	0.034	0.032	0.028
		R-30	20	0.039	0.036	0.034	0.032	0.031	0.030	0.028	0.025
		R-38	21	0.030	0.028	0.027	0.025	0.025	0.024	0.023	0.021
		R-44	22	0.026	0.025	0.024	0.022	0.022	0.022	0.021	0.019
		R-49	23	0.023	0.022	0.021	0.020	0.020	0.019	0.019	0.017
	R-60	24	0.019	0.018	0.018	0.017	0.017	0.016	0.016	0.015	

Notes:

- 1 Continuous insulation shall be located at the ceiling or at the roof and be uninterrupted by framing.
2. In climate zones 1 and 16 the insulating R-value of continuous insulation materials installed above the roofs waterproof membrane shall be multiplied by 0.8 before choosing the table column for determining assembly U-factor.

This table contains U-factors for metal-framed attic roofs, where the ceiling is the air barrier and the attic is ventilated. This construction assembly is similar to those that are covered by Table 4.2.1, except that metal framing members are substituted for the wood-framing members. The top chord of the truss is typically sloped, while the bottom chord is typically flat. Data from this table may be used for cases where the bottom chord of the truss is sloped. If the bottom chord slopes more than 4:12, nonadhesive binder blown insulation must not be used.

For the majority of cases, values will be selected from column A of this table. Column A applies for the common situation where either batt or blown insulation is placed directly over the ceiling. Builders or designers may increase thermal performance by adding a continuous insulation layer at the ceiling. The continuous insulation is typically a rigid polystyrene or polyisocyanurate foam insulation. Continuous insulation does not include the blown or batt insulation that is over the bottom chord of the truss (this is already accounted for in the first column data).

When this table is used manually, the R-value of continuous insulation shall be equal to or greater than the R-value published in the continuous insulation columns. No interpolation is permitted when data from the table is used manually. CEC approved software, however, may determine the U-factor for any amount of continuous insulation and for unusual construction layers using Equation 4-1 and Equation 4-2.

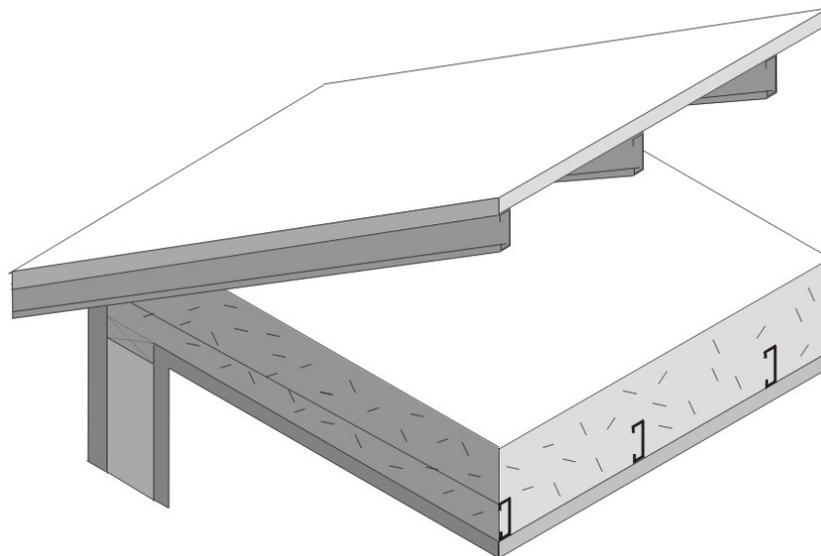


Figure 4.2.54 – Metal Framed Attic Roofs

Assumptions: These data are calculated using the zone method calculation documented in the 2005-2009 ASHRAE Handbook of Fundamentals. These calculations assume an exterior air film of R-0.17, asphalt shingles of R-0.44 (AR02), building paper of R-0.06 (BP01), ½ inch of wood based sheathing (Custom), the

attic air space (greater than 3.5 inch) of R-0.80, the insulation / framing layer, continuous insulation (if any) 1/2 inch gypsum of R-0.45 (GP01), and an interior air film (heat flow up) of R-0.61. The framing percentage is assumed to be 10 percent for 16 inch on center and 7 percent for 24 inch on center 7.25 percent of the attic insulation above the framing members is assumed to be at half depth, due to decreased depth of insulation at the eaves. Steel framing has 1.5 inch flange and is 0.0747 inch thick steel with no knockouts. U-factors calculated using EZ Frame 2.0.

Table 4.2.5 – U-factors of Metal Framed Rafter Roofs

Spacing	R-Value of Insulation Between Framing	Nominal Framing Size		Rated R-value of Continuous Insulation ⁶ Insulation							
				R-0	R-2	R-4	R-6	R-7	R-8	R-10	R-14
				A	B	C	D	E	F	G	H
16 in. OC	None	Any	1	0.325	0.197	0.141	0.110	0.099	0.090	0.076	0.059
	R-11 ²	2x4	2	0.129	0.103	0.085	0.073	0.068	0.063	0.056	0.046
	R-13 ²	2x4	3	0.121	0.097	0.082	0.070	0.066	0.061	0.055	0.045
	R-15 ²	2x4	4	0.115	0.093	0.079	0.068	0.064	0.060	0.053	0.044
	R-19 ^{2,3}	2x4	5	0.121	0.097	0.082	0.070	0.066	0.061	0.055	0.045
	R-11	2x6	6	0.123	0.099	0.082	0.071	0.066	0.062	0.055	0.045
	R-13	2x6	7	0.115	0.093	0.079	0.068	0.064	0.060	0.053	0.044
	R-15 ²	2x6	8	0.101	0.084	0.072	0.063	0.059	0.056	0.050	0.042
	R-19 ²	2x6	9	0.100	0.083	0.071	0.063	0.059	0.056	0.050	0.042
	R-19 ²	2x8	10	0.096	0.081	0.069	0.061	0.057	0.054	0.049	0.041
	R-21	2x8	11	0.093	0.078	0.068	0.060	0.056	0.053	0.048	0.040
	R-25	2x10	12	0.084	0.072	0.063	0.056	0.053	0.050	0.046	0.039
	R-30 ⁴	2x10	13	0.079	0.068	0.060	0.054	0.051	0.048	0.044	0.038
	R-30	2x12	14	0.076	0.066	0.058	0.052	0.050	0.047	0.043	0.037
	R-38 ⁴	2x12	15	0.071	0.062	0.055	0.050	0.047	0.045	0.042	0.036
	R-38 ⁴	2x14	16	0.068	0.060	0.053	0.048	0.046	0.044	0.040	0.035
	Sprayed Foam or Cellulose Insulation ^{2,5}	2x6	17	0.099	0.083	0.071	0.062	0.058	0.055	0.050	0.041
2x8		18	0.087	0.074	0.065	0.057	0.054	0.051	0.047	0.039	
2x10		19	0.077	0.067	0.059	0.053	0.050	0.048	0.044	0.037	
2x12		20	0.069	0.061	0.054	0.049	0.047	0.044	0.041	0.035	
2x14		21	0.064	0.057	0.051	0.046	0.044	0.042	0.039	0.034	
24 in. OC	None	Any	22	0.322	0.196	0.141	0.110	0.099	0.090	0.076	0.058
	R-11 ²	2x4	23	0.111	0.091	0.077	0.067	0.062	0.059	0.053	0.043
	R-13 ²	2x4	24	0.102	0.085	0.072	0.063	0.060	0.056	0.050	0.042
	R-15 ²	2x4	25	0.096	0.081	0.069	0.061	0.057	0.054	0.049	0.041
	R-19 ^{2,3}	2x4	26	0.102	0.085	0.072	0.063	0.060	0.056	0.050	0.042
	R-11	2x6	27	0.107	0.088	0.075	0.065	0.061	0.058	0.052	0.043
	R-13	2x6	28	0.099	0.083	0.071	0.062	0.058	0.055	0.050	0.041
	R-15 ²	2x6	29	0.086	0.073	0.064	0.057	0.054	0.051	0.046	0.039
	R-19 ²	2x6	30	0.083	0.071	0.062	0.055	0.052	0.050	0.045	0.038
	R-19 ²	2x8	31	0.080	0.0690	0.061	0.054	0.051	0.049	0.044	0.038
	R-21	2x8	32	0.076	0.066	0.058	0.052	0.050	0.047	0.043	0.037
	R-25	2x10	33	0.068	0.060	0.053	0.048	0.046	0.044	0.040	0.035
	R-30 ⁴	2x10	34	0.063	0.056	0.050	0.046	0.044	0.042	0.039	0.033
	R-30	2x12	35	0.061	0.054	0.049	0.045	0.043	0.041	0.038	0.033
	R-38 ⁴	2x12	36	0.055	0.050	0.045	0.041	0.040	0.038	0.035	0.031
	R-38 ⁴	2x14	37	0.053	0.048	0.044	0.040	0.039	0.037	0.035	0.030

Sprayed Foam or Cellulose Insulation ^{2,5}	2x6	38	0.084	0.070	0.064	0.055	0.052	0.049	0.045	0.038
	2x8	39	0.070	0.064	0.055	0.049	0.047	0.045	0.041	0.035
	2x10	40	0.064	0.054	0.049	0.045	0.043	0.041	0.038	0.033
	2x12	41	0.054	0.049	0.044	0.041	0.039	0.038	0.035	0.031
	2x14	42	0.049	0.045	0.044	0.038	0.036	0.035	0.033	0.029

Notes:

1. Rigid foam board used for cavity insulation must fill the entire cavity between the rafters and be sealed properly to prevent air gaps, and must be secured properly to prevent any future discrepancies in the construction assembly.
2. This assembly is only allowed where ventilation is provided between the bottom of the roof deck and the top of the insulation meeting CBC requirements or enforcement agency officials approval of rafter attic assemblies with no ventilation air spaces.
3. This assembly requires insulation with an R-value per inch 5.6 or larger (k-factor 1.8 or less). This is board type insulation, mostly Isocyanurate. Medium density spray polyurethane foam may also be used to meet this requirement if the quality installation procedures and documentation in Joint Appendix 7 are followed. Documentation from Directory of Certified insulation materials must be provided to show compliance with this assembly.
4. Higher density fiberglass batt is needed to achieve the indicated U-factor. R-30 must be achieved with less than 8.25 inch- full thickness. R-38 must be achieved with less than 10.25 inch thickness (R-30c, R-38c).
5. ~~Foamed plastic or cellulose insulation shall fill the entire cavity. Cellulose shall have a binder to prevent sagging. Verify that the building official in your area permits this construction, since there is no ventilation layer.~~
6. ~~Continuous insulation shall be located at the ceiling or at the roof and be uninterrupted by framing. In climate zones 1 and 16 the insulating R value of continuous insulation materials installed above the roof's waterproof membrane shall be multiplied by 0.8 before choosing the table column for determining assembly U-factor.~~

This table contains pre-calculated U-factors for metal-framed rafter roofs where the ceiling is the air barrier.

This construction assembly is similar to that covered by Table 4.2.2 except that metal framing members are substituted for the wood-framing members. The rafters may be either flat or in a sloped application. Insulation is typically installed between the rafters. With this construction, the insulation is in contact with the ceiling and there is typically a one-inch air gap above the insulation so that moisture can be vented. Whether or not there is an air space above the insulation depends on local climate conditions and may not be required in some building permit jurisdictions. ~~The building official will need to waive the air gap requirement to allow the use of cellulose insulation or sprayed foam.~~

U-factors are selected from Column A of this table when there is no continuous insulation. When continuous insulation is installed either at the ceiling or at the roof, then U-factors from other columns may be selected. The continuous insulation is typically a rigid polystyrene or polyisocyanurate foam insulation, but can also include mineral wool or other suitable materials.

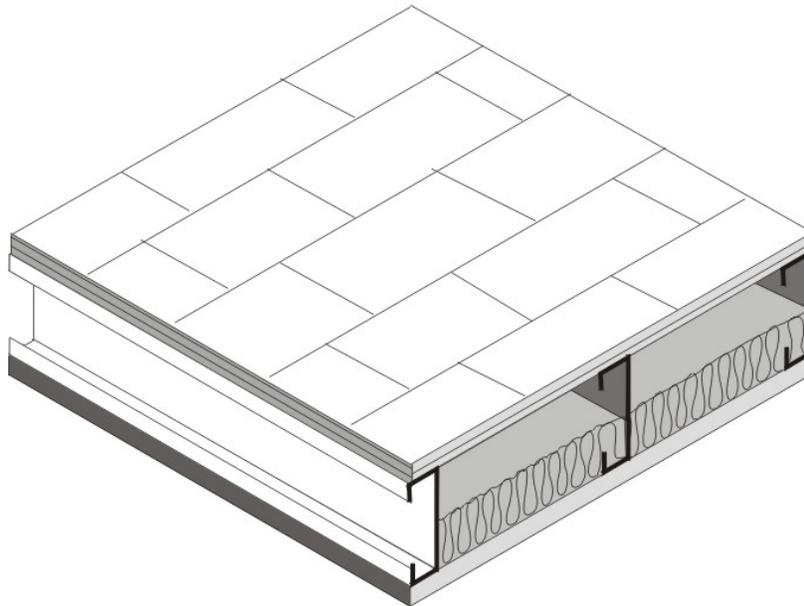


Figure 4.2.65 – Metal Framed Rafter Roof

When this table is used manually, the R-value of continuous insulation shall be equal to or greater than the R-value published in the continuous insulation columns. For instance if the insulation is R-3, the R-2 column shall be used. No interpolation is permitted when data from the table is used manually. CEC approved software, however, may determine the U-factor for any amount of continuous insulation and/or for unusual construction layers using Equation 4-1 and Equation 4-2.

Assumptions: These data are calculated using the zone calculation method documented in the 2005-2009 ASHRAE Handbook of Fundamentals. These calculations assume an exterior air film of R-0.17, asphalt shingles of R-0.44 (AR02), building paper of R-0.06 (BP01), ½ inch of wood based sheathing (Custom), the insulation / framing layer, ½ inch gypsum of R-0.45 (GP01), and an interior air film (heat flow up diagonally) of R-0.62. The continuous insulation may either be located at the ceiling or over the structural deck. The thickness of framing members is assumed to be 3.50, 5.50, 7.25, 9.25, and 11.25 inch for 2x4, 2x6, 2x8, 2x10, and 2x12 nominal sizes. High-density batt insulation is assumed to be 8.5 in. thick for R-30 and 10.5 in thick for R-38. Framing spacing is 10 percent for 16 inches on center and 7 percent for 24 inches on center. Steel framing has 1.5 inch flange and is 0.075 inch thick steel with no knockouts. U-factors calculated using EZ Frame 2.0.

Table 4.2.6 –U-factors for Span Deck and Concrete Roofs

Fireproofing	Concrete Topping Over Metal Deck	R-value of Continuous Insulation										
		None	R-4	R-6	R-8	R-10	R-12	R-15	R-20	R-25	R-30	
		A	B	C	D	E	F	G	H	I	J	
Yes	None	1	0.348	0.145	0.113	0.092	0.078	0.067	0.056	0.044	0.036	0.030
	2 in.	2	0.324	0.141	0.110	0.090	0.076	0.066	0.055	0.043	0.036	0.030
	4 in.	3	0.302	0.137	0.107	0.088	0.075	0.065	0.055	0.043	0.035	0.030
	6 in.	4	0.283	0.133	0.105	0.087	0.074	0.064	0.054	0.042	0.035	0.030
No	None	5	0.503	0.167	0.125	0.100	0.083	0.071	0.059	0.045	0.037	0.031
	2 in.	6	0.452	0.161	0.122	0.098	0.082	0.070	0.058	0.045	0.037	0.031
	4 in.	7	0.412	0.156	0.119	0.096	0.080	0.069	0.057	0.045	0.036	0.031
	6 in.	8	0.377	0.150	0.116	0.094	0.079	0.068	0.057	0.044	0.036	0.031

1. In climate zones 1 and 16 the insulating R-value of continuous insulation materials installed above the roof waterproof membrane shall be multiplied by 0.8 before choosing the table column for determining assembly U-factor.

The constructions in this table are typical of Type I and Type II steel framed or concrete nonresidential buildings. The construction consists of a metal deck with or without a concrete topping. It may also be used for a metal deck or even wood deck ceiling as long as the insulation is continuous. Fireproofing may be sprayed onto the underside of the metal deck; it also covers steel structural members. Insulation is typically installed above the structural deck and below the waterproof membrane. This table may also be used for reinforced concrete roofs that do not have a metal deck. In this case, the fireproofing will typically not be installed and choices from the table should be made accordingly.

When this table is used manually, the R-value of continuous insulation shall be equal to or greater than the R-value published in the continuous insulation columns. No interpolation is permitted when data from the table is used manually. CEC approved compliance software, however, may determine the U-factor for any amount of continuous insulation and for unusual construction layers using Equation 4-1 and Equation 4-2. If the data is adjusted using Equation 4-2, the user shall take credit for a ceiling and the air space above the ceiling only if the ceiling serves as an air barrier. Suspended or T-bar ceilings do not serve as air barriers.

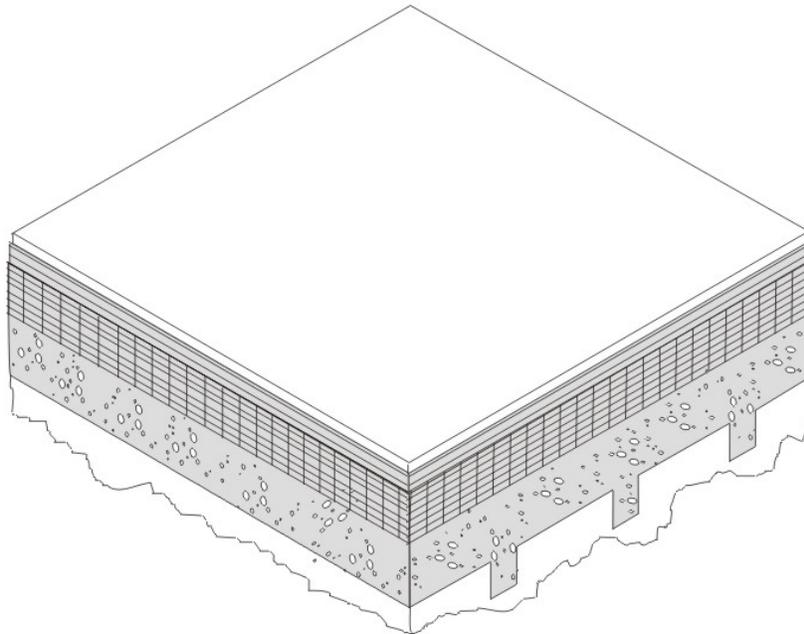


Figure 4.2.76 – Span Deck and Concrete Roof

Assumptions: These calculations are made using the parallel path method documented in the 2005-2009 ASHRAE Handbook of Fundamentals. The assembly is assumed to consist of an exterior air film of R-0.17, a single ply roofing membrane (R-0.15), protective board (R-1.06), continuous insulation (if any), concrete topping with a density of 120 lb/ft and an R-value of 0.11 per inch (if any), metal span deck (negligible), and fireproofing (R-0.88). While a suspended ceiling typically exists below the structure, this is not considered part of the construction assembly therefore the same U-values are used for assemblies with or without suspended ceilings. The fireproofing is assumed to be equivalent to 60 lb/ft³ concrete with a resistance of 0.44 per inch.

Table 4.2.7 – U-factors for Metal Building Roofs

Insulation System	R-Value of Insulation	Rated R-value of Continuous Insulation										
		R-0	R-4	R-6	R-8	R-10	R-12	R-15	R-20	R-25	R-30	
		A	B	C	D	E	F	G	H	I	J	
Screw Down Roofs (no Thermal Blocks) ²	None	1	1.280	0.209	0.147	0.114	0.093	0.078	0.063	0.048	0.039	0.032
	R-10	2	0.153	0.095	0.080	0.069	0.060	0.054	0.046	0.038	0.032	0.027
	R-11	3	0.139	0.089	0.076	0.066	0.058	0.052	0.045	0.037	0.031	0.027
	R-13	4	0.130	0.086	0.073	0.064	0.057	0.051	0.044	0.036	0.031	0.027
	R-19	5	0.098	0.070	0.062	0.055	0.049	0.045	0.040	0.033	0.028	0.025
Standing Seam Roof with Single Layer of Insulation Draped over Purlins and Compressed. Thermal blocks at supports. ²	R-10	6	0.097	0.070	0.061	0.055	0.049	0.045	0.040	0.033	0.028	0.025
	R-11	7	0.092	0.067	0.059	0.053	0.048	0.044	0.039	0.032	0.028	0.024
	R-13	8	0.083	0.062	0.055	0.050	0.045	0.042	0.037	0.031	0.027	0.024
	R-19	9	0.065	0.052	0.047	0.043	0.039	0.037	0.033	0.028	0.025	0.022
Standing Seam Roof with Double Layer of Insulation. ³ Thermal blocks at supports. ²	R-10 + R-10	10	0.063	0.050	0.046	0.042	0.039	0.036	0.032	0.028	0.024	0.022
	R-10 + R-11	11	0.061	0.049	0.045	0.041	0.038	0.035	0.032	0.027	0.024	0.022
	R-11 + R-11	12	0.060	0.048	0.044	0.041	0.038	0.035	0.032	0.027	0.024	0.021
	R-10 + R-13	13	0.058	0.047	0.043	0.040	0.037	0.034	0.031	0.027	0.024	0.021
	R-11 + R-13	14	0.057	0.046	0.042	0.039	0.036	0.034	0.031	0.027	0.024	0.021
	R-13 + R-13	15	0.055	0.045	0.041	0.038	0.035	0.033	0.030	0.026	0.023	0.021
	R-10 + R-19	16	0.052	0.043	0.040	0.037	0.034	0.032	0.029	0.025	0.023	0.020
	R-11 + R-19	17	0.051	0.042	0.039	0.036	0.034	0.032	0.029	0.025	0.022	0.020
	R-13 + R-19	17	0.049	0.041	0.038	0.035	0.033	0.031	0.028	0.025	0.022	0.020
R-19 + R-19	18	0.046	0.039	0.036	0.034	0.032	0.030	0.027	0.024	0.021	0.019	
Filled Cavity with Thermal Blocks ^{2,4}	R19 + R-10	19	0.041	0.035	0.033	0.031	0.029	0.027	0.025	0.023	0.020	0.018

Notes:

1. A roof must have metal purlins no closer than 4 ft on center to use this table. If the roof deck is attached to the purlins more frequently than 12 in oc, 0.008 must be added to the U-factors in this table.
2. Thermal blocks are an R-5 of rigid insulation, which extends 1" beyond the width of the purlin on each side.
3. Multiple R-values are listed in order from outside to inside. First layer is parallel to the purlins, and supported by a system; second layer is laid on top of the purlins.
4. In climate zones 1 and 16 the insulating R-value of continuous insulation materials installed above the roof waterproof membrane shall be multiplied times 0.8 before choosing the table column for determining assembly U-factor.

The U-factors in this table are intended for use with metal building roofs. This type of construction is typical for manufacturing and warehouse facilities, but is used for other building types as well. The typical method of insulating this type of building is to drape vinyl backed fiberglass insulation over the metal purlins before the metal deck is attached with metal screws. With this method, the insulation is compressed at the supports, reducing its effectiveness. The first part of the table contains values for this insulation technique. The second section of the table has data for the case when a thermal block is used at the support. The insulation is still compressed, but the thermal block, which generally consists of an 8 inch wide strip of foam insulation, improves the thermal performance. The third section of the table deals with systems that involve two layers of insulation.

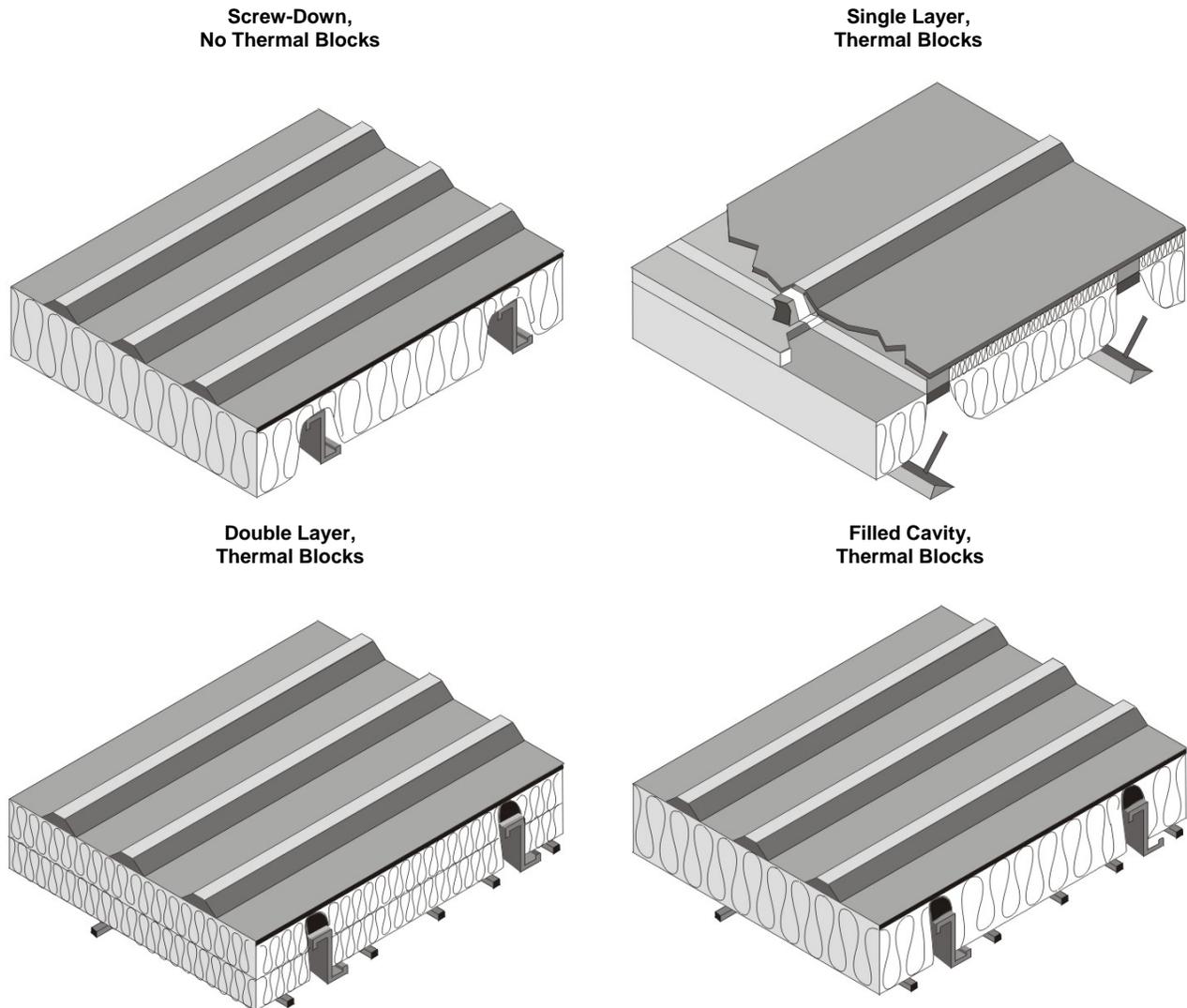


Figure 4.2.8Z – Metal Building Roofs

For the majority of cases, values will be selected from column A of this table. Builders or designers may increase thermal performance by adding a continuous insulation layer between the metal decking and the structural supports. The continuous insulation is typically a rigid polystyrene or polyisocyanurate foam insulation.

When this table is used manually, the R-value of continuous insulation shall be equal to or greater than the R-value published in the continuous insulation columns. No interpolation is permitted when data from the table is used manually. CEC approved compliance software, however, may determine the U-factor for any amount of continuous insulation using Equation 4-1.

Assumptions: Data in Column A of this table is taken from the ASHRAE/IESNA Standard 90.1-2004, Appendix A. The data is also published in the NAIMA *Compliance for Metal Buildings*, 1997.

Table 4.2.8 – U-factors for Insulated Ceiling with Removable Panels

R-value of Insulation Over Suspended Ceiling	U-factor	
	A	
None	1	0.304
7	2	0.152
11	3	0.132
13	4	0.126
19	5	0.113
21	6	0.110
22	7	0.109
30	8	0.102
38	9	0.098
49	10	0.094
60	11	0.092

This table includes U-factors for the case of insulation placed over suspended ceilings. This situation is only permitted for a combined floor area no greater than 2,000 square feet in an otherwise unconditioned building, and when the average height of the space between the ceiling and the roof over these spaces is greater than 12 feet. The suspended ceiling does not provide an effective air barrier and leakage is accounted for in the calculations.

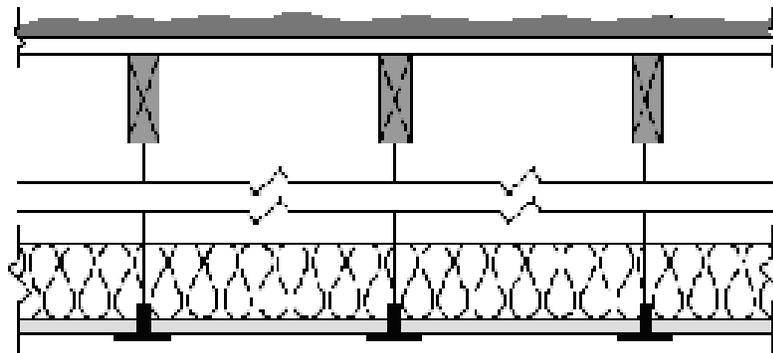


Figure 4.2.98 – Insulated Ceiling with Removable Panels

Assumptions: These calculations assume an exterior air film of R-0.17, a built-up roof of R-0.33 (BR01), ¼ inch wood based sheathing (Custom), a twelve foot air space of R-0.80, the insulation (for the insulated portion), removable ceiling panels with a R-0.50 and an interior air film (heat flow up) of R-0.61. 75 percent of the ceiling is assumed covered by insulation and the remainder is not insulated. The uninsulated portion includes lighting fixtures and areas where the insulation is not continuous. A correction factor of 0.005 is added to the resulting U-factor to account for infiltration through the suspended ceiling and lighting fixtures.

Table 4.2.9 – U-factors of Insulated Metal Panel Roofs and Ceilings

Panel Thickness	U-factor (Btu/°F-ft ²)	
	A	
2"	1	0.079
2 ½"	2	0.064
3"	3	0.054
4"	4	0.041
5"	5	0.033
6"	6	0.028

This table contains thermal performance data (U-factors) for foamed-in-place, insulated metal panels consisting of liquid polyurethane or polyisocyanurate injected between metal skins in individual molds or on fully automated production lines. Metal building construction is the most common application for this product where the metal panel is fastened to the frame of the structure. This table can only be used for insulated panels that are factory built. This table does not apply to panels that utilize polystyrene, or to field applied products such as spray applied insulations.

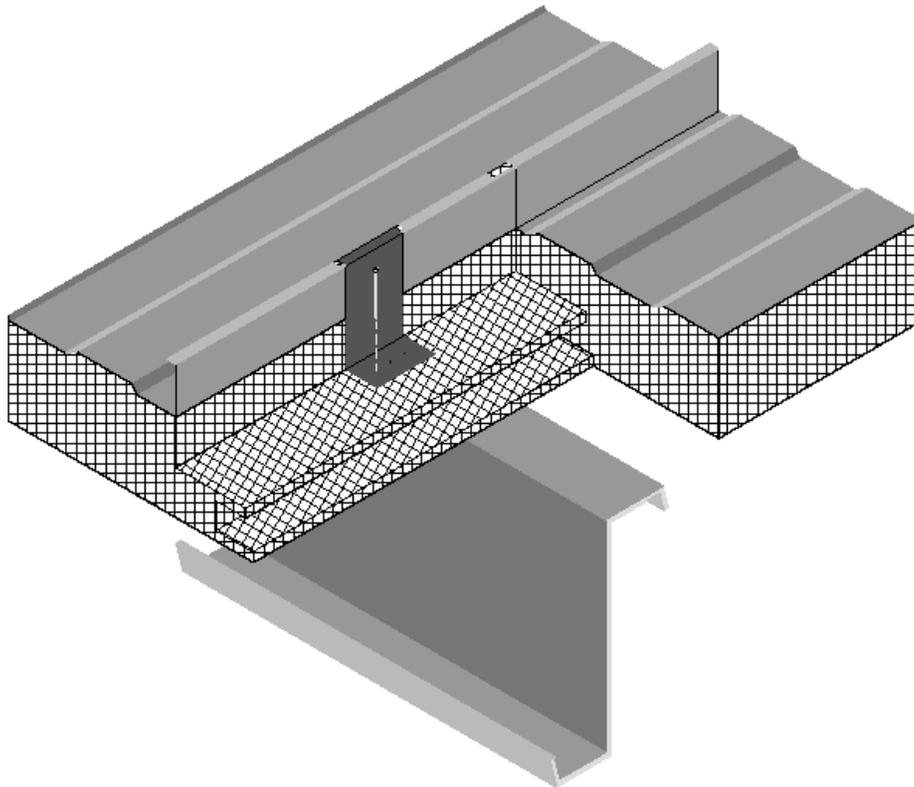


Figure 4.2.9 – Insulated Metal Panel Roofs

Assumptions: These data are calculated using the parallel path method documented in the 2005-2009 ASHRAE Handbook of Fundamentals. These calculations assume an exterior air film of R-0.17, light gauge metal exterior of R-0.0747, continuous insulation R-5.9 per inch, light gauge metal interior of 0.0747 inch thickness and an interior air film (heat flow up) of R-0.61. The panels are assumed to be continuous with no framing penetration. The R-value of the light gauge metal is negligible.

4.3 Walls

Table 4.3.1 – U-factors of Wood Framed Walls

Spacing	Cavity Insulation	Nominal Framing Size	Rated R-value of Continuous Insulation ²								
			R-0	R-2	R-4	R-6	R-7				
			A	B	C	D	E				
16 in. OC	None	Any	1	0.356	0.208	0.147	0.114	0.102			
	R-11 batt	2x4	2	0.110	0.090	0.076	0.066	0.062			
	R-13 batt	2x4	3	0.102	0.085	0.072	0.063	0.060			
	R-15 batt ¹	2x4	4	0.095	0.080	0.069	0.061	0.057			
	R-19 batt	2x6	5	0.074	0.064	0.057	0.051	0.049			
	R-21 batt ¹	2x6	6	0.069	0.061	0.054	0.049	0.047			
	R-19 batt	2x8	7	0.065	0.058	0.052	0.047	0.045			
	R-22 batt	2x8	8	0.061	0.054	0.049	0.045	0.043			
	R-25 batt	2x8	9	0.057	0.051	0.046	0.042	0.041			
	R-30 batt ¹	2x8	10	0.055	0.050	0.045	0.041	0.040			
	R-30 batt	2x10	11	0.047	0.043	0.040	0.037	0.035			
	R-38 batt	2x10	12	0.046	0.042	0.039	0.036	0.035			
	R-38 batt	2x12	13	0.039	0.036	0.034	0.032	0.031			
	Foamed Plastic or Cellulose Insulation ³	2x4	14	0.103	0.085	0.073	0.064	0.060			
		2x6	15	0.074	0.062	0.055	0.050	0.047			
		2x8	16	0.056	0.050	0.046	0.042	0.040			
		2x10	17	0.045	0.041	0.038	0.035	0.034			
		2x12	18	0.038	0.035	0.033	0.031	0.030			
24 in. OC	None	Any	19	0.362	0.210	0.148	0.114	0.102			
	R-11 batt	2x4	20	0.106	0.087	0.074	0.065	0.061			
	R-13 batt	2x4	21	0.098	0.082	0.070	0.062	0.058			
	R-15 batt	2x4	22	0.091	0.077	0.067	0.059	0.056			
	R-19 batt	2x6	23	0.071	0.062	0.055	0.050	0.047			
	R-21 batt ¹	2x6	24	0.066	0.058	0.052	0.047	0.045			
	R-19 batt	2x8	25	0.063	0.056	0.050	0.046	0.044			
	R-22 batt	2x8	26	0.058	0.052	0.047	0.043	0.041			
	R-25 batt	2x8	27	0.056	0.050	0.046	0.042	0.040			
	R-30 batt ¹	2x8	28	0.053	0.048	0.044	0.040	0.039			
	R-30 batt	2x10	29	0.045	0.041	0.038	0.035	0.034	0.033	0.034	0.028
	R-38 batt	2x10	30	0.044	0.040	0.037	0.035	0.034	0.033	0.034	0.027
	R-38 batt	2x12	31	0.038	0.035	0.033	0.031	0.030	0.029	0.028	0.025
	Foamed Plastic or Cellulose Insulation ³	2x4	32	0.099	0.083	0.071	0.062	0.058	0.055	0.050	0.041
		2x6	33	0.069	0.059	0.054	0.049	0.047	0.044	0.041	0.035
		2x8	34	0.054	0.049	0.044	0.041	0.039	0.038	0.035	0.031
		2x10	35	0.044	0.040	0.037	0.035	0.034	0.033	0.034	0.027
		2x12	36	0.036	0.034	0.031	0.030	0.029	0.028	0.026	0.024

Notes

1. Higher density fiberglass batt is required in these cases.
2. Continuous insulation may be installed on either the inside or the exterior of the wall, or both.
3. ~~Foamed plastic and cellulose shall fill the entire cavity. Cellulose shall have a binder to prevent sagging.~~

This table contains U-factors for wood framed walls, which are typical of low-rise residential buildings and Type V nonresidential buildings. If continuous insulation is not used, then choices are made from Column A. In this case, the insulation is installed between the framing members. When continuous insulation is also used, this is typically installed on the exterior side of the wall, but can also be used on the inside. The continuous insulation is typically a rigid polystyrene or polyisocyanurate foam insulation.

When this table is used manually, the R-value of continuous insulation shall be equal to or greater than the R-value published in the continuous insulation columns. Continuous insulation of at least R-2 must exist in order to use this table. No interpolation is permitted when data from the table is used manually. CEC approved compliance software, however, may determine the U-factor for any amount of continuous insulation or for unusual construction assemblies using Equation 4-1 and Equation 4-2.

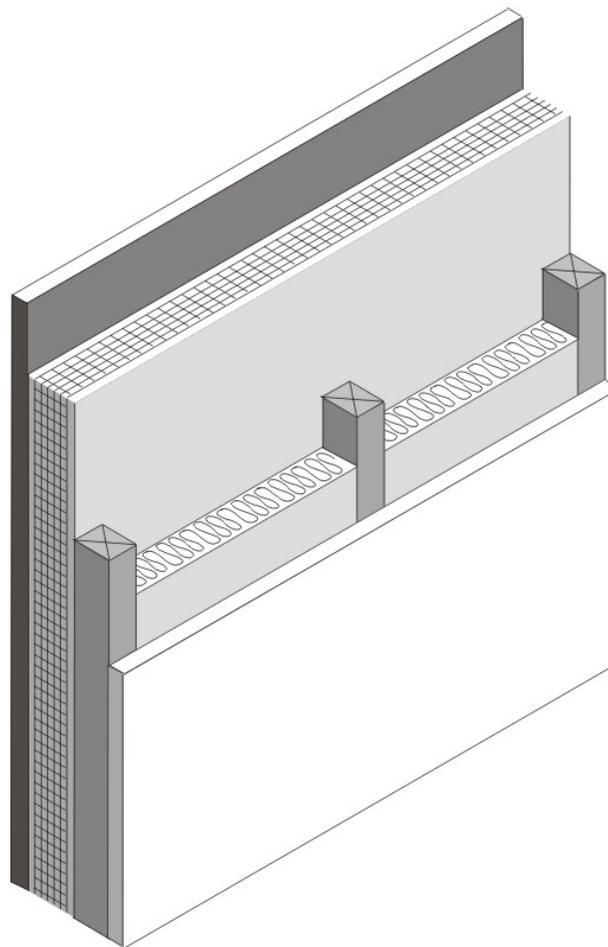


Figure 4.3.1 – Wood Framed Wall

Assumptions: Values in this table were calculated using the parallel heat flow calculation method, documented in the 2005-2009 ASHRAE Handbook of Fundamentals. The construction assembly assumes an exterior air film of R-0.17, a 7/8 inch layer of stucco of R-0.18 (SC01), building paper of R-0.06 (BP01), continuous insulation (if any), the cavity insulation / framing layer, 1/2 inch gypsum board of R-0.45 (GP01), and an interior air film 0.68. The framing factor is assumed to be 25 percent for 16 inch stud spacing and 22 percent for 24 inch spacing. ~~Foam plastic and cellulose are assumed to entirely fill the cavity and have a thermal~~

resistance of R-3.6 per inch. Actual cavity depth is 3.5 inch for 2x4, 5.5 inch for 2x6, 7.25 inch for 2x8, 9.25 inch for 2x10, and 11.25 inch for 2x12. High density R-30 insulation is assumed to be 8.5 inch thick batt and R-38 is assumed to be 10.5 inch thick. The thickness of the stucco is assumed to be reduced to 3/8 inch when continuous insulation is applied.

Table 4.3.2 – U-factors of Structurally Insulated Wall Panels (SIPs)

Wood Framing Connection Type (spline)	Insulation Core R-value ¹	Typical Panel Thickness		Rated R-value of Continuous Insulation ²⁵		
				None	R-2	R-4
				A	B	C
OSB	R-14 ¹	4.5 in.	1	0.061	0.055	0.049
Single 2x	R-14 ²	4.5 in.	2	0.071	0.061	0.054
Double 2x	R-14 ³	4.5 in.	3	0.077	0.065	0.057
I-joist	R-14 ²	4.5 in.	4	0.070	0.060	0.053
OSB	R-18 ¹	4.5 in.	5	0.053	0.045	0.041
Single 2x	R-18 ²	4.5 in.	6	0.061	0.052	0.047
Double 2x	R-18 ³	4.5 in.	7	0.066	0.056	0.050
I-joist	R-18 ²	4.5 in.	8	0.059	0.051	0.046
OSB	R-24 ¹	6.5 in.	9	0.041	0.038	0.036
Single 2x	R-24 ²	6.5 in.	10	0.050	0.044	0.040
Double 2x	R-24 ³	6.5 in.	11	0.054	0.048	0.043
I-joist	R-24 ²	6.5 in.	12	0.048	0.043	0.039
OSB	R-28 ¹	8.25 in.	13	0.032	0.030	0.029
Single 2x	R-28 ²	8.25 in.	14	0.039	0.036	0.033
Double 2x	R-28 ³	8.25 in.	15	0.043	0.039	0.035
I-joist	R-28 ²	8.25 in.	16	0.037	0.034	0.032
OSB	R-33 ¹	6.5 in.	17	0.032	0.029	0.027
Single 2x	R-33 ²	6.5 in.	18	0.038	0.034	0.031
Double 2x	R-33 ³	6.5 in.	19	0.043	0.038	0.034
I-joist	R-33 ²	6.5 in.	20	0.036	0.033	0.030
OSB	R-36 ¹	10.25 in.	21	0.026	0.024	0.023
Single 2x	R-36 ²	10.25 in.	22	0.032	0.030	0.028
Double 2x	R-36 ³	10.25 in.	23	0.035	0.032	0.030
I-joist	R-36 ²	10.25 in.	24	0.030	0.028	0.026
OSB	R-44 ¹	12.25 in.	25	0.022	0.021	0.020
Single 2x	R-44 ²	12.25 in.	26	0.027	0.025	0.024
Double 2x	R-44 ³	12.25 in.	27	0.028	0.027	0.025
I-joist	R-44 ²	12.25 in.	28	0.025	0.024	0.022
OSB	R-55 ¹	10.25 in.	29	0.020	0.019	0.017
Single 2x	R-55 ²	10.25 in.	30	0.024	0.022	0.021
Double 2x	R-55 ³	10.25 in.	31	0.028	0.025	0.023
I-joist	R-55 ²	10.25 in.	32	0.022	0.021	0.019

Notes:

1. The insulation R-value must be at least R-14 in order to use this table. This table assumes moulded expanded polystyrene (EPS) unless noted otherwise. Although other insulation types are used by some SIP manufacturers, such as polyurethane and extruded expanded insulation (XPS), EPS is the most common insulation used in SIP construction.
 2. R-18.1 is achievable using extruded expanded polystyrene (XPS) insulation in 4.5" thick panels.
 3. R-33.2 is achievable using polyurethane insulation in 6.5" panels.
 4. R-55.3 is achievable using polyurethane insulation in 10.25" panels.
 5. Continuous insulation shall be at least R-2 and may be installed on either the inside or the exterior of the wall.
-

Type	Insulation R-value	Framing or Spline Spacing	Rated R-value of Continuous Insulation ²								
			None	R-2	R-4	R-6	R-7	R-8	R-10	R-14	
			A	B	C	D	E	F	G	H	
Wood Spacers	R-14 ¹	48 in. o.c.	1	0.077	0.067	0.059	0.053	0.050	0.048	0.043	0.037
	R-22	48 in. o.c.	2	0.053	0.048	0.044	0.040	0.039	0.037	0.035	0.034
	R-26 ³	48 in. o.c.	3	0.054	0.049	0.045	0.041	0.039	0.038	0.035	0.034
	R-28	48 in. o.c.	4	0.042	0.039	0.036	0.034	0.033	0.032	0.030	0.027
	R-36	48 in. o.c.	5	0.034	0.032	0.030	0.028	0.028	0.027	0.025	0.023
	R-40 ³	48 in. o.c.	6	0.038	0.035	0.033	0.031	0.030	0.029	0.027	0.025
	R-44	48 in. o.c.	7	0.029	0.027	0.026	0.024	0.024	0.023	0.022	0.020
OSB Spline	R-14 ¹	48 in. o.c.	8	0.064	0.055	0.049	0.045	0.043	0.041	0.038	0.033
	R-22	48 in. o.c.	9	0.041	0.038	0.036	0.033	0.032	0.031	0.029	0.026
	R-26	48 in. o.c.	10	NA							
	R-28	48 in. o.c.	11	0.032	0.030	0.029	0.027	0.026	0.026	0.024	0.022
	R-36	48 in. o.c.	12	0.026	0.024	0.023	0.022	0.022	0.021	0.020	0.019
	R-40	48 in. o.c.	13	NA							
	R-44	48 in. o.c.	14	0.022	0.021	0.020	0.019	0.019	0.018	0.018	0.017

Notes:

1. The insulation R-value must be at least R-14 in order to use this table.
2. For credit, continuous insulation shall be at least R-2 and may be installed on either the inside or the exterior of the wall.
3. Entries for R-26 and R-40 correspond to SIP panels with a rigid polyisocyanurate insulation core which has a higher R-value per inch than the other assemblies but it is used in thinner panels.

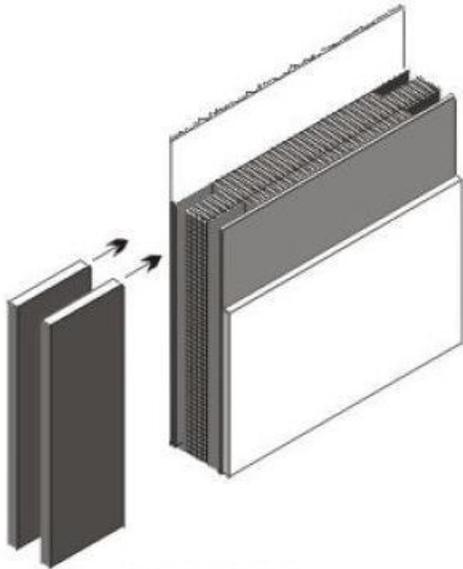
Structural insulated panels (SIPs) consist of a rigid insulation core, securely bonded between two structural facings, to form a structural sandwich panel. SIPs are considered a non-framed assembly usually with little or no structural framing that penetrates the insulation layer, resulting in less thermal bridging across the insulation when compared to a conventional framed assembly.

This table gives U-factors for structurally insulated panels used in wall construction. This is a construction system that consists of rigid foam insulation sandwiched between two layers of plywood or oriented strand board (OSB). Data is provided for two four variations of this connecting two panels together system. The system labeled "Wood Spacers" uses wood spacers to separate the plywood or OSB boards and provide a means to connect the panels with mechanical fasteners. The system labeled "OSB Spline" uses splines to connect the panels so that framing members does not penetrate the insulation.

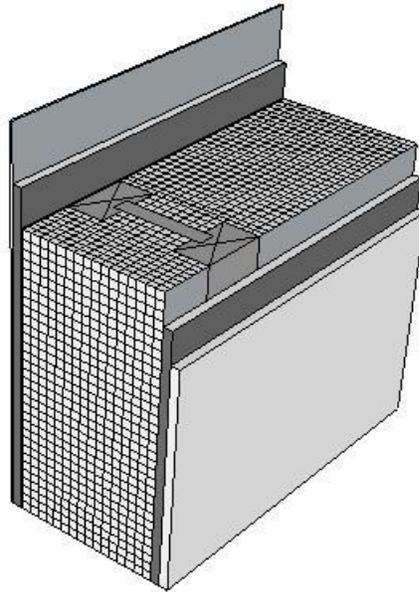
If continuous insulation is not used, then choices are made from Column A. When continuous insulation is also used, this is typically installed on the exterior side of the wall, but can also be used on the inside. The continuous insulation is typically a rigid polystyrene or polyisocyanurate foam insulation. Adding continuous insulation to a SIPs panel is highly unusual since the panel itself is mostly continuous insulation.

When this table is used manually, the R-value of continuous insulation shall be equal to or greater than the R-value published in the continuous insulation columns. Continuous insulation of at least R-2 must exist in order to use this table. No interpolation is permitted when data from the table is used manually. CEC approved software, however, may determine the U-factor for any amount of continuous insulation or for unusual construction assemblies using Equation 4-1 and Equation 4-2.

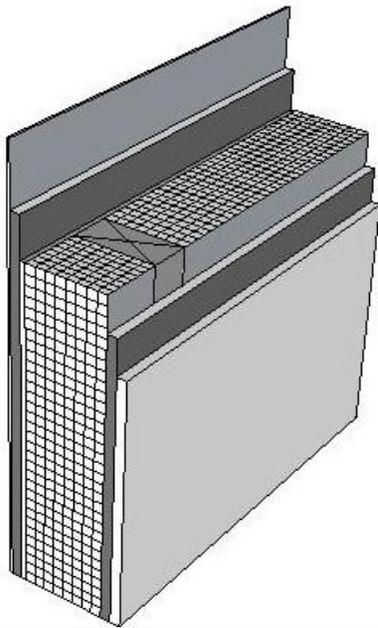
OSB Spline



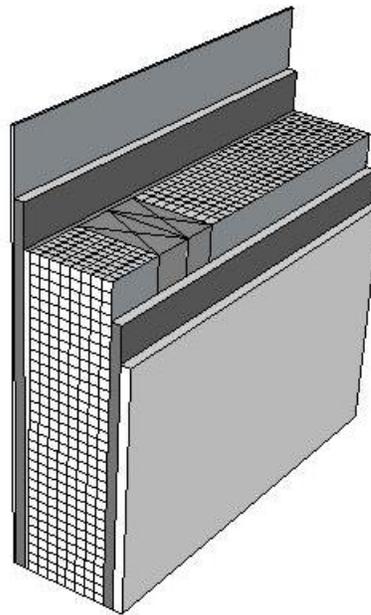
I-Joist Spline



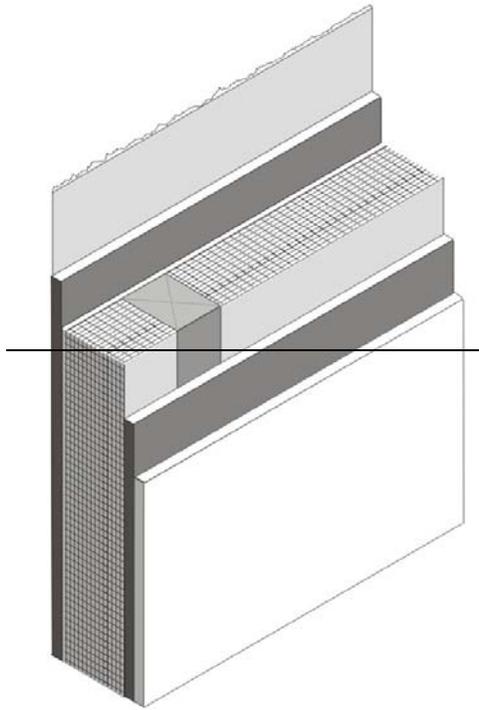
Single 2x Spline



Double 2x Spline



Wood Spacers



OSB-Spline

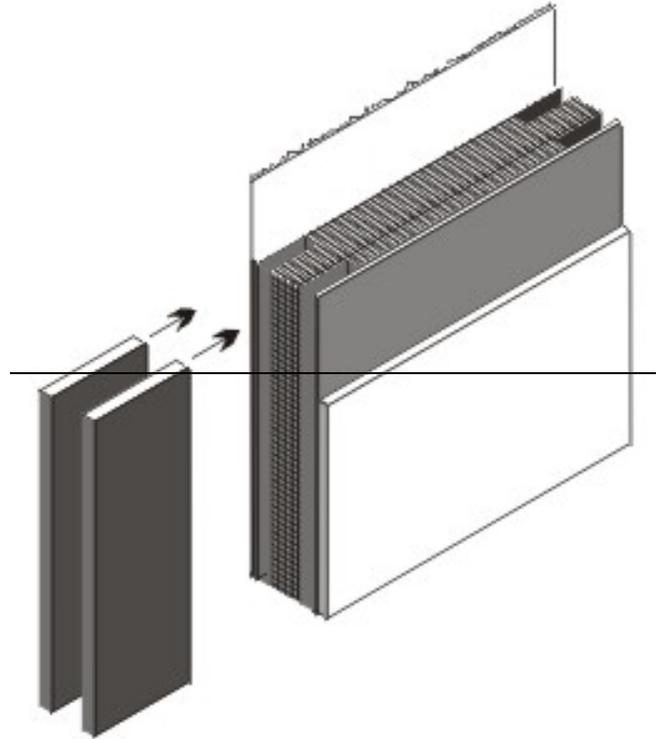


Figure 4.3.2 – Structurally Insulated Wall Panels (SIPS)

This figure shows just one way that panels are connected. Other options exist.

Assumptions: These data are calculated using the parallel path method documented in the 2009~~5~~ ASHRAE Handbook of Fundamentals.

These calculations assume an exterior air film of R-0.17, a 7/8 inch layer of stucco of R-0.18, building paper of R-0.06 (BP01), 7/16 inch of OSB of R-0.44, insulation at carrying R-values (as specified), 7/16 inch of OSB of R-0.44, 1/2 inch gypsum board of R-0.45 (GP01), and in interior air film of R-0.68. A framing factor of 13 percent is assumed for wood spacers and 7 percent for the OSB spline system. Framing includes the sill plate, the header and framing around windows and doors. These calculations assume an exterior air film of R-0.17, a 7/8 inch layer of stucco of R-0.18, building paper of R-0.06 (BP01), 7/16 inch of OSB of R-0.44, insulation at R-3.85 per inch (as specified), 7/16 inch of OSB of R-0.44, 1/2 inch gypsum board of R-0.45 (GP01), and an interior air film of R-0.68. The R-26 and R-40 wood spacer walls are calculated using polyisocyanurate insulation at R-7 per inch. A framing factor of 13 percent is assumed for wood spacers and 7 percent for the OSB spline system. Framing includes the sill plate, the header and framing around windows and doors

Table 4.3.3 – U-factors of Metal Framed Walls for Nonresidential Construction

Spacing	Cavity Insulation R-Value:	Nominal Framing Size	Rated R-value of Continuous Insulation ²					
			R-0	R-2	R-4	R-6	R-7	
			A	B	C	D	E	
16 in. OC	None	Any	1	0.458	0.239	0.162	0.122	0.109
	R-5	2x4	2	0.351	0.203	0.144	0.112	0.101
	R-11	2x4	23	0.244	0.155	0.118	0.096	0.087
	R-13	2x4	34	0.217	0.151	0.116	0.094	0.086
	R-15	2x4	54	0.211	0.148	0.114	0.093	0.085
	R-19	2x6	65	0.183	0.134	0.106	0.087	0.080
	R-21 ¹	2x6	76	0.178	0.131	0.104	0.086	0.079
	R-19	2x8	87	0.164	0.123	0.099	0.083	0.076
	R-22	2x8	98	0.160	0.121	0.098	0.082	0.075
	R-25	2x8	910	0.158	0.120	0.097	0.081	0.075
	R-30 ¹	2x8	110	0.157	0.119	0.096	0.081	0.075
	R-30	2x10	11	0.140	0.109	0.090	0.076	0.071
	R-38 ⁺	2x10	12	0.139	0.109	0.089	0.076	0.070
	R-38	2x12	13	0.124	0.099	0.083	0.071	0.066
	Foamed Plastic or Cellulose Insulation ³	2x4	14	0.218	0.152	0.116	0.094	0.086
		2x6	15	0.179	0.132	0.104	0.086	0.079
		2x8	16	0.157	0.119	0.096	0.081	0.075
		2x10	17	0.138	0.108	0.089	0.075	0.070
2x12		18	0.123	0.099	0.082	0.071	0.066	
24 in. OC	None	Any	204	0.455	0.238	0.161	0.122	0.109
	R-5	2x4	21	0.333	0.200	0.143	0.111	0.100
	R-11	2x4	225	0.210	0.148	0.114	0.093	0.085
	R-13	2x4	236	0.203	0.144	0.112	0.092	0.084
	R-15	2x4	247	0.197	0.141	0.110	0.090	0.083
	R-19	2x6	258	0.164	0.123	0.099	0.083	0.076
	R-21 ¹	2x6	269	0.161	0.122	0.098	0.082	0.076
	R-19	2x8	3270	0.153	0.117	0.095	0.080	0.074
	R-22	2x8	284	0.149	0.115	0.093	0.079	0.073
	R-25	2x8	329	0.147	0.114	0.093	0.078	0.072
	R-30 ¹	2x8	303	0.146	0.113	0.092	0.078	0.072
	R-30	2x10	34	0.130	0.103	0.086	0.073	0.068
	R-38 ⁺	2x10	35	0.128	0.102	0.085	0.072	0.068
	R-38	2x12	36	0.115	0.093	0.079	0.068	0.064

Foamed Plastic or Cellulose Insulation ³	2 x 4	37	0.204	0.145	0.112	0.092	0.084
	2 x 6	38	0.167	0.125	0.100	0.083	0.077
	2 x 8	39	0.146	0.113	0.092	0.078	0.072
	2 x 10	40	0.128	0.102	0.085	0.072	0.068
	2 x 12	41	0.114	0.093	0.078	0.068	0.063

Notes

1. Higher density fiberglass batt is required in these cases.
2. Continuous insulation may be installed on either the inside or the exterior of the wall, or both.
3. Foamed plastic and cellulose shall fill the entire cavity. Cellulose shall have a binder to prevent sagging.

This table contains U-factors for steel or metal-framed walls, which are typical of nonresidential buildings. The table may be used for any construction assembly where the primary insulation is installed in a metal-framed wall, e.g. uninsulated curtain walls with metal furring on the inside.

If continuous insulation is not used, then choices are made from Column A. In this case, the insulation is installed only between the framing members. When continuous insulation is also used, it is typically installed on the exterior side of the wall, but can also be used on the inside. The continuous insulation is typically a rigid polystyrene or polyisocyanurate foam insulation.

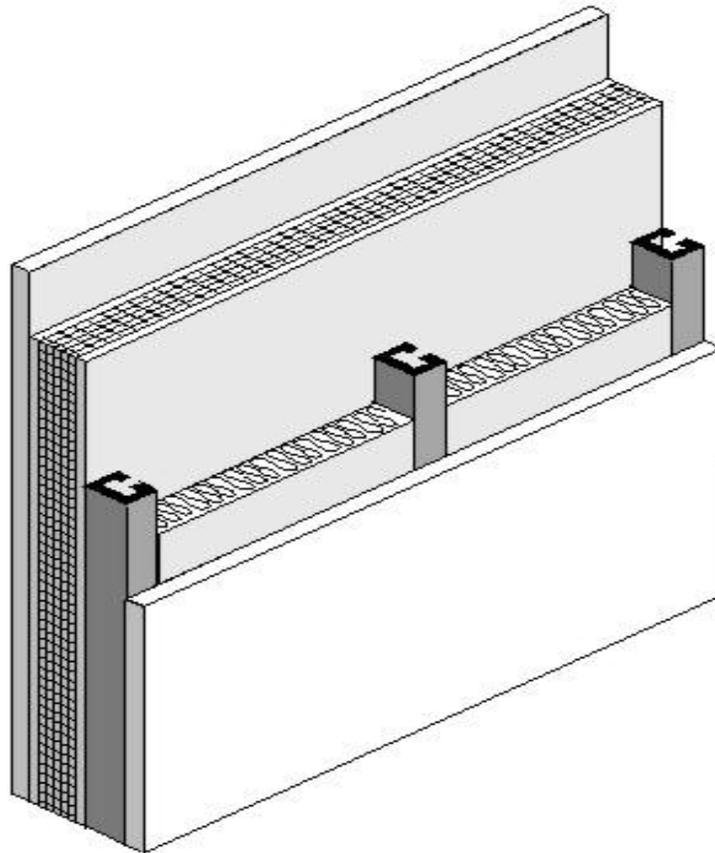


Figure 4.3.3 – Metal Framed Wall

When this table is used manually, the R-value of continuous insulation shall be equal to or greater than the R-value published in the continuous insulation columns. Continuous insulation of at least R-2 must exist in order to use values for continuous insulation. No interpolation is permitted when data from the table is used manually. CEC approved compliance software programs, however, may determine the U-factor for any amount of continuous insulation or for unusual construction assemblies using Equation 4-1 and Equation 4-2.

Assumptions: Values in this table were calculated using the zone calculation method. The construction assembly assumes an exterior air film of R-0.17, a 7/8 inch layer of stucco of R-0.18, building paper of R-0.06 (BP01), continuous insulation (if any), the insulation / framing layer, 1/2 inch gypsum of R-0.45 gypsum board (GP01), and an interior air film 0.68. The steel framing is assumed to be 0.0747 inch thick with a 15 percent knock out. The framing factor is assumed to be 25 percent for 16 inch stud spacing and 22 percent for 24 inch spacing. The EZFrame internal default framing percentages are 15 percent for 16 inch stud spacing and 12 percent for 24 inch spacing. To account for the increased wall framing percentage the frame spacing input to the EZ Frame program is reduced to 13.218 inches for 16 inch stud spacing and 15.231 inches for 24 inch stud spacing. ~~Foam plastic and cellulose are assumed to entirely fill the cavity and have a thermal resistance of R-3.6 per inch.~~ Actual cavity depth is 3.5 inch for 2x4, 5.5 inch for 2x6, 7.25 inch for 2x8, 9.25 inch for 2x10, and 11.25 inch for 2x12. High density R-30 insulation is assumed to be 8.5 inch thick batt and R-38 is assumed to be 10.5 inch thick. The thickness of the stucco is assumed to be reduced to 3/8 inch when continuous insulation is applied.

Table 4.3.4 – U-factors of Metal Framed Walls for Residential Construction

Spacing	Cavity Insulation R-Value:	Nominal Framing Size	Rated R-value of Continuous Insulation ²						
			R-0	R-2	R-4	R-5	R-6	R-7	
			A	B	C	D	E	F	
16 in. OC	None	Any	1	0.455	0.238	0.161	0.139	0.122	0.109
	R-11	2x4	2	0.200	0.137	0.107	0.097	0.088	0.081
	R-13	2x4	3	0.192	0.132	0.105	0.095	0.087	0.080
	R-15	2x4	4	0.186	0.129	0.102	0.093	0.085	0.078
	R-19	2x6	5	0.154	0.112	0.092	0.084	0.077	0.072
	R-21 ¹	2x6	6	0.151	0.110	0.090	0.083	0.076	0.071
	R-19	2x8	7	0.134	0.102	0.085	0.078	0.072	0.067
	R-22	2x8	8	0.129	0.099	0.082	0.076	0.071	0.066
	R-25	2x8	9	0.125	0.096	0.081	0.075	0.069	0.065
	R-30 ¹	2x8	10	0.120	0.093	0.078	0.073	0.068	0.063
	R-30	2x10	11	0.109	0.086	0.073	0.068	0.064	0.060
	R-38 ¹	2x10	12	0.104	0.082	0.071	0.066	0.062	0.058
	R-38	2 x 12	13	0.095	0.077	0.067	0.062	0.059	0.055
	Foamed Plastic or Cellulose Insulation ³	2 x 4	14	0.177	0.134	0.104	0.094	0.086	0.079
		2 x 6	15	0.152	0.119	0.095	0.087	0.080	0.074
		2 x 8	16	0.124	0.098	0.082	0.076	0.070	0.066
		2 x 10	17	0.105	0.087	0.074	0.069	0.064	0.060
		2 x 12	18	0.092	0.077	0.067	0.063	0.059	0.056
24 in. OC	None	Any	24	0.449	0.236	0.161	0.138	0.121	0.108
	R-11	2x4	25	0.189	0.131	0.104	0.094	0.086	0.079
	R-13	2x4	26	0.181	0.127	0.101	0.092	0.084	0.078
	R-15	2x4	27	0.175	0.123	0.099	0.090	0.082	0.076
	R-19	2x6	28	0.144	0.107	0.088	0.081	0.075	0.070
	R-21 ¹	2x6	29	0.141	0.105	0.086	0.080	0.074	0.069
	R-19	2x8	30	0.126	0.097	0.081	0.075	0.070	0.065
	R-22	2x8	31	0.121	0.094	0.079	0.073	0.068	0.064
	R-25	2x8	32	0.117	0.091	0.077	0.071	0.067	0.063
	R-30 ¹	2x8	33	0.112	0.088	0.075	0.069	0.065	0.061
	R-30	2x10	34	0.102	0.081	0.070	0.065	0.061	0.058
	R-38 ¹	2x10	35	0.096	0.077	0.067	0.063	0.059	0.056
R-38	2 x 12	36	0.088	0.072	0.063	0.059	0.056	0.053	

Foamed Plastic or Cellulose Insulation ³	2 x 4	37	0.182	0.133	0.105	0.095	0.087	0.080
	2 x 6	38	0.146	0.112	0.092	0.084	0.078	0.072
	2 x 8	39	0.121	0.097	0.081	0.075	0.070	0.066
	2 x 10	40	0.101	0.084	0.072	0.067	0.063	0.059
	2 x 12	41	0.087	0.074	0.064	0.060	0.057	0.054

Notes

1. Higher density fiberglass batt is required in these cases.
2. Continuous insulation may be installed on either the inside or the exterior of the wall, or both.
3. ~~Foamed plastic and cellulose shall fill the entire cavity. Cellulose shall have a binder to prevent sagging.~~

This table contains U-factors for steel or metal framed walls in low-rise residential buildings where the thickness of the framing members is 18 gauge or thinner. Table 4.3.3 in Reference Joint Appendix JA4 must be used for steel or metal-framed walls in nonresidential buildings (including high-rise residential buildings and hotels and motels) and in low rise residential buildings if the thickness of the framing members are thinner than 18 gauge.

If continuous insulation is not used, then choices are made from Column A. In this case, the insulation is installed only between the framing members. When continuous insulation is also used, it is typically installed on the exterior side of the wall, but can also be used on the inside. The continuous insulation is typically a rigid polystyrene or polyisocyanurate foam insulation.

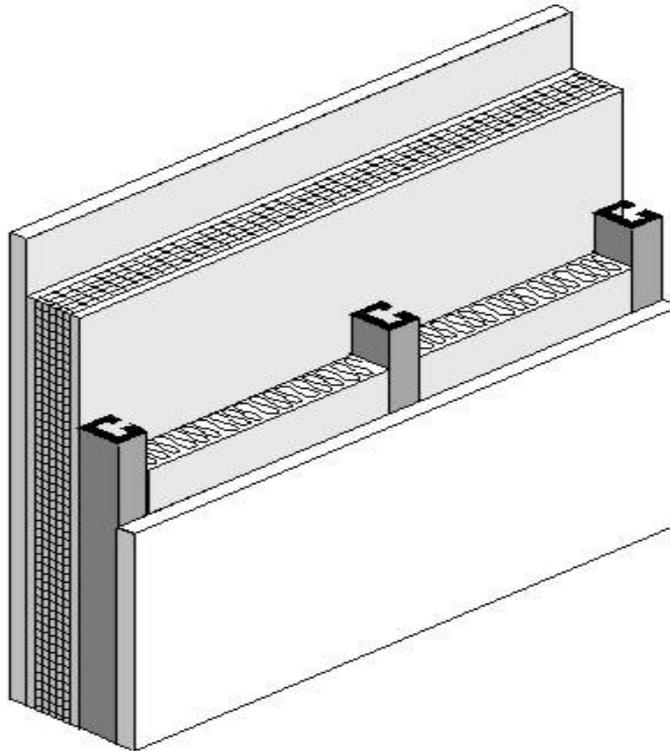


Figure 4.3.4 – Metal Framed Wall

When this table is used manually, the R-value of continuous insulation shall be equal to or greater than the R-value published in the continuous insulation columns. Continuous insulation of at least R-2 must exist in order to use values for continuous insulation. No interpolation is permitted when data from the table is used manually. CEC approved compliance software programs, however, may determine the U-factor for any amount of continuous insulation or for unusual construction assemblies using Equation 4-1 and Equation 4-2.

Assumptions: Values in this table were calculated using the zone calculation method. The construction assembly assumes an exterior air film of R-0.17, a 7/8 inch layer of siding or stucco averaging R-0.18, building paper of R-0.06 (BP01), continuous insulation (if any), the insulation / framing insulation layer, 1/2 inch gypsum of R-0.45 gypsum board (GP01), and an interior air film 0.68. The framing factor is assumed to be 25 percent for 16 inch stud spacing and 22 percent for 24 inch spacing. To account for the increased wall framing percentage, the frame spacing input to the EZ Frame program is reduced to 13.218 inches for 16 inch stud spacing and 15.231 inches for 24 inch stud spacing. The stud web thickness is assumed to be 0.038 inches, which is a 50/50 mix of 18 gauge and 20 gauge C-channel studs. This value was confirmed to be representative of low-rise residential construction by polling several California-based light-gauge steel structural engineers and light-gauge steel framers. ~~Foam plastic and cellulose are assumed to entirely fill the cavity and have a thermal resistance of R-3.6 per inch.~~ Actual cavity depth is 3.5 inch for 2x4, 5.5 inch for 2x6, 8 inch for 2x8, 10 inch for 2x10, and 12 inches for 2x12. High density R-30 insulation is assumed to be 8.5 inch thick batt and R-38 is assumed to be 10.5 inches thick. The thickness of the stucco is assumed to be reduced to 3/8 inch when continuous insulation is applied.

Table 4.3.5 – Properties of Hollow Unit Masonry Walls

Thickness	Type	Partly Grouted with UngROUTed Cells									
		Solid Grout			Empty			Insulated			
		A			B			C			
		1	U-factor	C-factor	HC	U-factor	C-factor	HC	U-factor	C-factor	HC
12"	LW CMU	2	0.51	0.90	23	0.43	0.68	14.8	0.30	0.40	14.8
	MW CMU	3	0.54	1.00	23.9	0.46	0.76	15.6	0.33	0.46	15.6
	NW CMU	4	0.57	1.11	24.8	0.49	0.84	16.5	0.36	0.52	16.5
10"	LW CMU	5	0.55	1.03	18.9	0.46	0.76	12.6	0.34	0.48	12.6
	MW CMU	6	0.59	1.18	19.7	0.49	0.84	13.4	0.37	0.54	13.4
	NW CMU	7	0.62	1.31	20.5	0.52	0.93	14.2	0.41	0.63	14.2
8"	LW CMU	8	0.62	1.31	15.1	0.50	0.87	9.9	0.37	0.54	9.9
	MW CMU	9	0.65	1.45	15.7	0.53	0.96	10.5	0.41	0.63	10.5
	NW CMU	10	0.69	1.67	16.3	0.56	1.07	11.1	0.44	0.70	11.1
	Clay Unit	11	0.57	1.11	15.1	0.47	0.78	11.4	0.39	0.58	11.4
6"	LW CMU	12	0.68	1.61	10.9	0.54	1.00	7.9	0.44	0.70	7.9
	MW CMU	13	0.72	1.86	11.4	0.58	1.14	8.4	0.48	0.81	8.4
	NW CMU	14	0.76	2.15	11.9	0.61	1.27	8.9	0.52	0.93	8.9
	Clay Unit	15	0.65	1.45	11.1	0.52	0.93	8.6	0.45	0.73	8.6

The walls addressed in this table are rarely used in residential construction, but are common in some types of nonresidential construction. The tables include four types of hollow masonry units: lightweight concrete masonry units (CMU), medium weight CMU, normal weight CMU, and hollow clay masonry units. ASTM C-90 defines these masonry products in more detail.

Masonry used in California must be reinforced to withstand wind loads and earthquakes. This is achieved by installing reinforcing steel and grouting the cells in both a vertical and horizontal direction. Since grouting the cells affects thermal performance, data is provided for three cases: where every cell is grouted, where the cells are partially grouted and the remaining cells are left empty, and where the cells are partially grouted and the remaining cells are filled with perlite or some other insulating material.

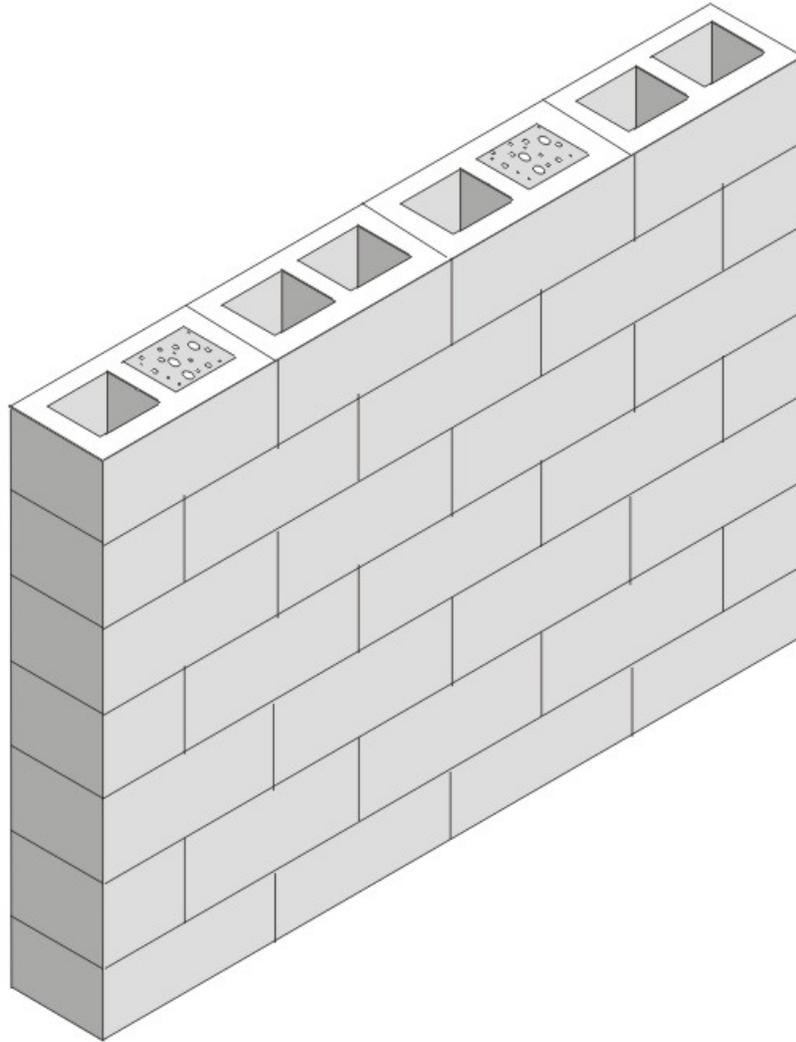


Figure 4.3.5 – Masonry Wall

For each of these conditions the U-factor, C-factor and heat capacity (HC) is published. There are other properties of mass materials that may be needed in compliance calculations, but these values can be determined from the published data using the procedures in Modeling Constructions in the Nonresidential compliance software and in Section 4.6 of this document.

Assumptions: Data is taken from *Energy Calculations and Data*, CMCN, 1986, Berkeley Solar Group; Concrete Masonry Association of California and Nevada. The density of the CMU material (not counting the grouted or hollow cells) is 105 lb/ft³ for lightweight, 115 lb/ft³ for medium weight and 125 lb/ft³ for normal weight. The density of the clay unit material is 130 lb/ft³. For all four types of masonry units, data is provided for thicknesses of 6 in., 8 in., 10 in., and 12 in. For the partially grouted cases, vertical cells are assumed to be grouted at 32 inch on center. Reinforcing in the horizontal direction is at 48 in. on center. Wall thicknesses given in the table are nominal; actual thicknesses are 3/8 in. less. Insulating material inside unit masonry hollow is assumed to be perlite.

Table 4.3.6 – Properties of Solid Unit Masonry and Solid Concrete Walls

Type	Property		Wall Thickness, inches									
			3	4	5	6	7	8	9	10	11	12
			A	B	C	D	E	F	G	H	I	J
LW CMU	U-Factor	1	0.79	0.71	0.65	0.59	0.54	0.51	0.47	0.44	0.42	0.39
	C-Factor		2.38	1.79	1.43	1.18	1.01	0.88	0.79	0.71	0.65	0.59
	HC		5.3	7.00	8.80	10.50	12.30	14.00	15.80	17.50	19.30	21.00
MW CMU	U-Factor	2	0.84	0.77	0.70	0.65	0.61	0.57	0.53	0.50	0.48	0.45
	C-Factor		2.94	2.22	1.75	1.47	1.25	1.10	0.98	0.88	0.80	0.74
	HC		5.80	7.70	9.60	11.5	13.40	15.30	17.30	19.20	21.10	23.00
NW CMU	U-Factor	3	0.88	0.82	0.76	0.71	0.67	0.63	0.60	0.56	0.53	0.51
	C-Factor		3.57	2.70	2.17	1.79	1.54	1.35	1.20	1.03	0.98	0.90
	HC		6.30	8.30	10.40	12.50	14.6	16.70	18.80	20.80	22.90	25.00
Clay Brick	U-Factor	4	0.80	0.72	0.66	na						
	C-Factor		2.50	1.86	1.50	na						
	HC		6.30	8.40	10.43	na						
Concrete	U-Factor	5	0.96	0.91	0.86	0.82	0.78	0.74	0.71	0.68	0.65	0.63
	C-Factor		5.22	4.02	3.20	2.71	2.31	1.99	1.79	1.61	1.45	1.36
	HC		7.20	9.60	12.00	14.40	16.80	19.20	21.60	24.00	26.40	28.80

This table provides thermal performance information for solid masonry units and solid concrete walls.

The walls addressed in this table are rarely used in residential construction, but are common in some types of nonresidential construction.

There are other properties of mass materials that may be needed in compliance calculations, but these values can be determined from the published data using the procedures in Modeling Constructions in the Nonresidential compliance software and in Section 4.6 of this document.

When insulation is added to the outside of masonry walls and/or when the inside is furred and insulated, the performance data in this table may be adjusted using Equation 4-4 and Equation 4-5 in coordination with Table 4.3.13.

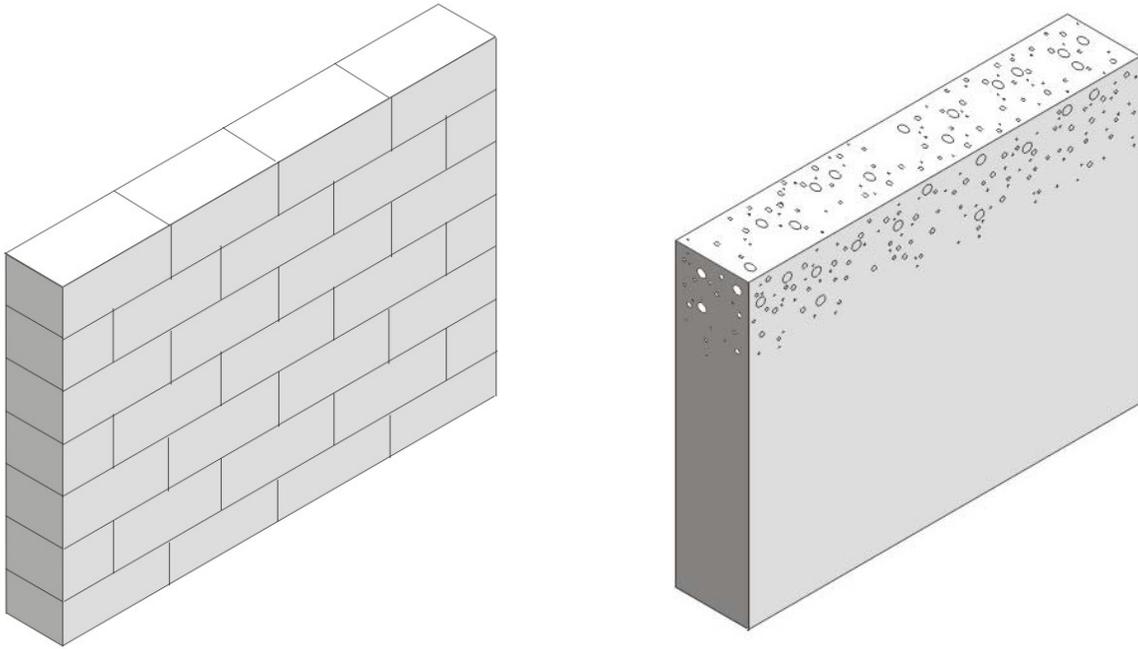


Figure 4.3.6 – Solid Unit Masonry (left) and Solid Concrete (right) Walls

Assumptions: Data is taken from ASHRAE/IESNA Standard 90.1-2004. The density of the CMU material is 105 lb/ft³ for lightweight, 115 lb/ft³ for medium weight and 125 lb/ft³ for normal weight. The density of the clay unit material is 130 lb/ft³ and the density of the concrete is 144 lb/ft³. For all five types of masonry walls, the U-factor, C-factor and heat capacity (HC) is provided for thicknesses of 3 inch, 4 inch, and 5 inch ASTM C-90 provides more information on the classification of masonry walls.

Table 4.3.7 – Properties of Concrete Sandwich Panels

Table 4.3.7 – Properties of Concrete Sandwich Panels

Percent Concrete Web	Steel Penetrates Insulation	Performance Factor	Insulation Thickness (R-value)				
			1.5 (7.0)	2.0 (9.3)	3.0 (14.0)	4.0 (18.6)	6.0 (27.9)
			A	B	C	D	E
0%	No	U-factor	0.122	0.095	0.066	0.051	0.034
		C-factor	0.136	0.104	0.070	0.053	0.035
		HC	16.13	16.13	16.13	16.13	16.13
	Yes	U-factor	0.164	0.128	0.091	0.070	0.048
		C-factor	0.190	0.144	0.099	0.074	0.050
		HC	16.13	16.13	16.13	16.13	16.13
10%	No	U-factor	0.476	0.435	0.345	0.286	0.217
		C-factor	0.800	0.690	0.488	0.377	0.267
		HC	16.53	16.66	16.93	17.20	17.74
	Yes	U-factor	0.500	0.435	0.357	0.303	0.227
		C-factor	0.870	0.690	0.513	0.408	0.282
		HC	16.53	16.66	16.93	17.20	17.74
20%	No	U-factor	0.588	0.556	0.476	0.417	0.333
		C-factor	1.176	1.053	0.800	0.645	0.465
		HC	16.93	17.20	17.74	18.28	19.35
	Yes	U-factor	0.588	0.556	0.476	0.417	0.333
		C-factor	1.176	1.053	0.800	0.645	0.465
		HC	16.93	17.20	17.74	18.28	19.35

		HC		16.53	16.66	16.93	17.20	17.74
		U-factor		0.588	0.556	0.476	0.417	0.333
	No	C-factor	5	1.176	1.053	0.800	0.645	0.465
20%		HC		16.93	17.20	17.74	18.28	19.35
		U-factor		0.588	0.556	0.476	0.417	0.333
	Yes	C-factor	6	1.176	1.053	0.800	0.645	0.465
		HC		16.93	17.20	17.74	18.28	19.35

This table provides U-factors, C-factors, and heat capacity (HC) data for concrete sandwich panels. Concrete sandwich panels, as the name suggests, consist of two layers of concrete that sandwich a layer of insulation. The wall system can be constructed in the field or in a factory. One method of field construction is where the wall panels are formed in a flat position using the concrete floor slab of the building as the bottom surface. After the panel has set, it is hoisted with a crane into its final vertical position.

Both the percent of concrete web and the percent steel are factors in determining the thermal performance of walls. The insulation layer in this type of concrete sandwich panel generally does not extend over the entire surface of the wall. To provide structural integrity, a certain portion of the wall is solid concrete, which ties together the two concrete layers. This portion is known as the concrete web. The thermal performance of concrete sandwich panels depends on the percent of the wall that is concrete web. Data is provided for concrete webs representing 0 percent, 10 percent and 20 percent of the opaque wall surface. In some cases, the concrete layers are tied together by structural steel that penetrates the insulation layer. Data is provided for the case where this steel is present and for cases where it is not.

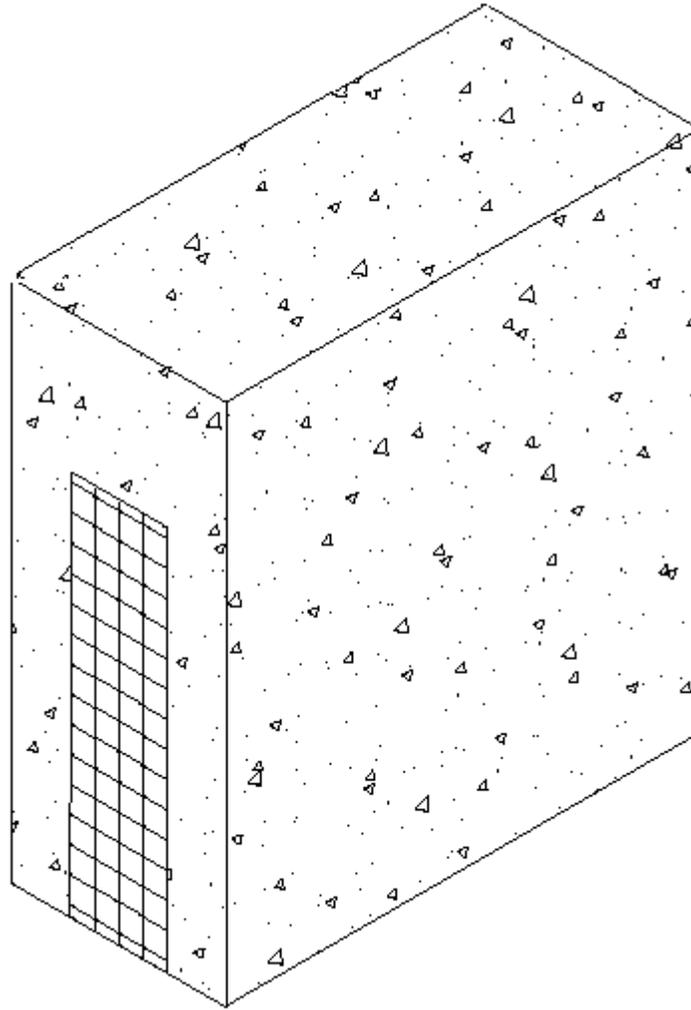


Figure 4.3.7 – Concrete Sandwich Panel

Other properties of mass materials such as density, conductivity, specific heat and wall weight may be needed in compliance calculations and these properties may be determined from the published data in Table 4.3.7 using the procedures in Modeling Constructions in the Nonresidential compliance software and in Section 4.6 of this document.

Values from this table may be combined with values from Table 4.3.13 when a furring layer is added to the inside of the wall and/or continuous insulation is added to the outside of the wall. Adjustments for additional layers shall follow the procedure of Equation 4-4 and Equation 4-5.

Assumptions: U-factors include an inside air film of 0.68 and an exterior air film of 0.17. Conductivity of the concrete is assumed to be 0.215 Btu/h-°F-f, density is 150 lb/ft³, the thickness of each side of the sandwich panel is 0.5 ft. The data was calculated by Construction Technologies Laboratories, Inc. and published in the Thermal Mass Handbook, Concrete and Masonry Design Provisions Using ASHRAE/IESNA 90.1-1989, National Codes and Standards Council of the Concrete and Masonry Industries, 1994.

Table 4.3.8 – U-factors for Spandrel Panels and Glass Curtain Walls

Frame Type	Spandrel Panel		Rated R-value of Insulation between Framing Members							
			None	R-4	R-7	R-10	R-15	R-20	R-25	R-30
			A	B	C	D	E	F	G	H
Aluminum without Thermal Break	Single glass pane, stone, or metal panel	1	0.361	0.248	0.229	0.219	0.210	0.206	0.203	0.201
	Double glass with no low-e coatings	2	0.301	0.239	0.224	0.216	0.209	0.205	0.202	0.200
	Triple or low-e glass	3	0.269	0.231	0.220	0.214	0.208	0.204	0.202	0.200
Aluminum with Thermal Break	Single glass pane, stone, or metal panel	4	0.351	0.215	0.191	0.179	0.168	0.161	0.158	0.155
	Double glass with no low-e coatings	5	0.280	0.204	0.186	0.175	0.166	0.160	0.157	0.154
	Triple or low-e glass	6	0.242	0.195	0.181	0.172	0.164	0.159	0.156	0.154
Structural Glazing	Single glass pane, stone, or metal panel	7	0.350	0.195	0.165	0.149	0.135	0.127	0.122	0.119
	Double glass with no low-e coatings	8	0.272	0.181	0.158	0.145	0.133	0.126	0.121	0.118
	Triple or low-e glass	9	0.227	0.169	0.152	0.141	0.131	0.124	0.120	0.117
No framing or Insulation is Continuous	Single glass pane, stone, or metal panel	10	0.361	0.148	0.102	0.078	0.056	0.044	0.036	0.031
	Double glass with no low-e coatings	11	0.301	0.137	0.097	0.075	0.055	0.043	0.035	0.030
	Triple or low-e glass	12	0.269	0.130	0.039	0.073	0.053	0.042	0.035	0.030

This table has U-factors for the spandrel section of glass and other curtain wall systems. Design factors that affect performance are the type of framing, the type of spandrel panel and the R-value of insulation.

Four framing conditions are considered in the table. The first is the common case where standard aluminum mullions are used. Standard mullions provide a thermal bridge through the insulation, reducing its effectiveness. The second case is for metal framing members that have a thermal break. A thermal break frame uses a urethane or other non-metallic element to separate the metal exposed to outside conditions from the metal that is exposed to interior conditions. The third case is for structural glazing or systems where there is no exposed mullion on the interior. The fourth case is for the condition where there is no framing or the insulation is continuous and uninterrupted by framing. The columns in the table can be used for any specified level of insulation between framing members installed in framed curtain walls or spandrel panels.

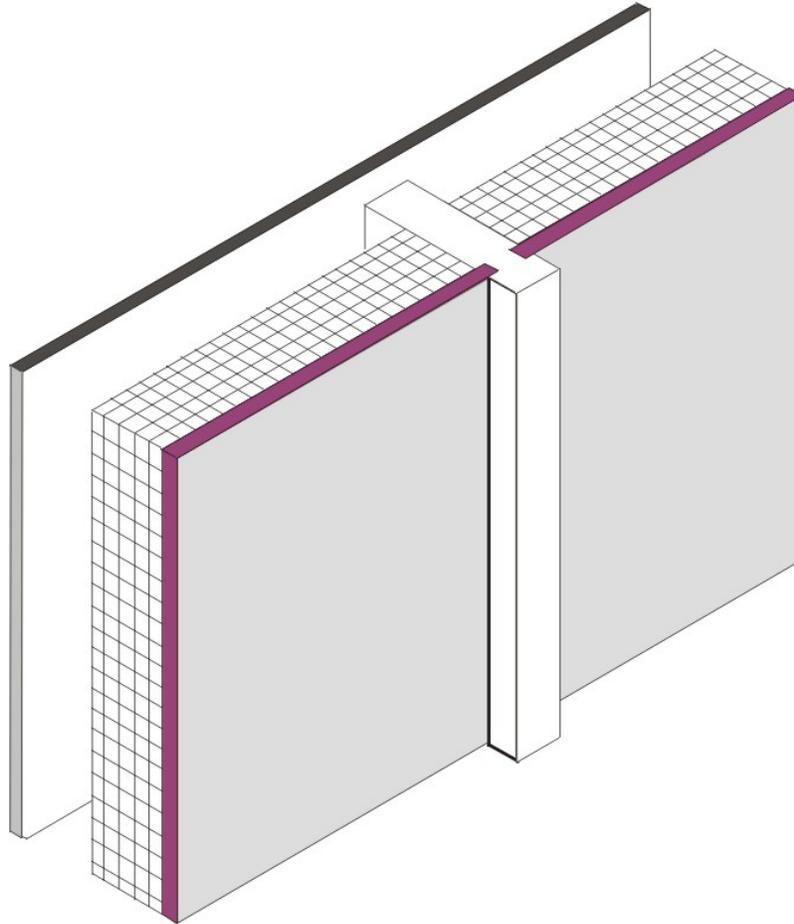


Figure 4.3.8 – Spandrel Panel

There are three spandrel panel cases considered in the table. The first is for a panel that provides little or no insulating value. This includes single pane glass, stone veneer, metal panels, or pre-cast concrete less than 2 inches thick. The second case is for insulating glass. Sometimes insulating glass is used so that the spandrel panel looks similar to the vision glass. The third case is for triple glass or double glass that has a low-e coating.

Insulation levels are shown in the columns of the table. When the table is used manually, the R-value of insulation shall be equal to or greater than the R-value published in the columns. No interpolation is permitted when data from the table is selected manually. California Energy Commission approved compliance software programs, including those used for prescriptive compliance, may accurately account for any amount of continuous insulation or for unusual construction assemblies using Equation 4-1 and Equation 4-2. If the curtain wall has an insulated metal-framed wall on the inside, then values from this table may be combined with values from Table 4.3.4 or Table 4.3.13 using the procedures of Equation 4-2 or Equation 4-3.

Assumptions: The U-factors in Table 4.3.8 were derived from a regression analysis of the values for “Glass Only Center of Glass” and “Curtain Wall” in the 2005 ASHRAE Handbook of Fundamentals, Chapter 30.31, Table 4. The U-factors in Table 4.3.8 include an exterior air film with an R-value of 0.17 and an interior air film R-value of 0.68, which are accounted for in the values from the 2005 ASHRAE Handbook of Fundamentals. The construction assembly consists of the Frame Type and Spandrel Panel combinations listed in Table 4.3.8, an air gap with an R-value of 1.39 (3/4 inch gap, 50 °F mean temperature and 30 °F temperature difference), and 5/8 inch gypsum board with an R-value of 0.56 that provides the interior finish. The gypsum board is assumed to span between the window sill and a channel at the floor.

The following equations were used when no rigid insulation is added to the assembly.

Aluminum Without Thermal Break

$$U_{\text{Overall}} = \frac{1}{(R_{\text{Gypsum}} + R_{\text{AirGap}}) + \left(\frac{1}{0.3007 + 0.8882 \times U_{\text{CenterofGlass}}} \right)} \quad \text{Equation 4-6}$$

Aluminum With Thermal Break

$$U_{\text{Overall}} = \frac{1}{(R_{\text{Gypsum}} + R_{\text{AirGap}}) + \left(\frac{1}{0.1936 + 0.8814 \times U_{\text{CenterofGlass}}} \right)} \quad \text{Equation 4-7}$$

Structural Glazing

$$U_{\text{Overall}} = \frac{1}{(R_{\text{Gypsum}} + R_{\text{AirGap}}) + \left(\frac{1}{0.1238 + 0.9448 \times U_{\text{CenterofGlass}}} \right)} \quad \text{Equation 4-8}$$

The following equations were used when rigid insulation is added to the assembly.

Aluminum Without Thermal Break

$$U_{\text{Overall}} = \frac{1}{(R_{\text{Gypsum}} + R_{\text{AirGap}}) + \left(\frac{1}{0.3007 + 0.8882 \times \left(\left(\frac{1}{R_{\text{AddedInsulation}}} \right) + U_{\text{CenterofGlass}} \right)} \right)} \quad \text{Equation 4-9}$$

Aluminum With Thermal Break

$$U_{\text{Overall}} = \frac{1}{(R_{\text{Gypsum}} + R_{\text{AirGap}}) + \left(\frac{1}{0.1936 + 0.8814 \times \left(\left(\frac{1}{R_{\text{AddedInsulation}}} \right) + U_{\text{CenterofGlass}} \right)} \right)} \quad \text{Equation 4-10}$$

Structural Glazing

$$U_{\text{Overall}} = \frac{1}{(R_{\text{Gypsum}} + R_{\text{AirGap}}) + \left(\frac{1}{0.1238 + 0.9448 \times \left(\left(\frac{1}{R_{\text{AddedInsulation}}} \right) + U_{\text{CenterofGlass}} \right)} \right)} \quad \text{Equation 4-11}$$

Table 4.3.9 – U-factors for Metal Building Walls

Insulation System	Rated R-Value of Insulation	Continuous Rigid Insulation								
		None	R-2	R-4	R-6	R-7	R-8	R-10	R-14	
		A	B	C	D	E	F	G	H	
Single Layer of Batt Insulation	None	1	1.18	0.351	0.206	0.146	0.127	0.113	0.092	0.067
	R-6	2	0.184	0.135	0.106	0.087	0.080	0.074	0.065	0.051
	R-10	3	0.134	0.106	0.087	0.074	0.069	0.065	0.057	0.047
	R-11	4	0.123	0.099	0.082	0.071	0.066	0.062	0.055	0.045
	R-13	5	0.113	0.092	0.078	0.067	0.063	0.059	0.053	0.044
Double Layer of Batt Insulation	R-6 + R-13	6	0.07	0.061	0.055	0.049	0.047	0.045	0.041	0.035
	R-10 + R-13	7	0.061	0.054	0.049	0.045	0.043	0.041	0.038	0.033
	R-13 + R-13	8	0.057	0.051	0.046	0.042	0.041	0.039	0.036	0.032
	R-19 + R-13	9	0.048	0.044	0.040	0.037	0.036	0.035	0.032	0.029

Double layer or batt insulation may not be able to have Continuous rigid insulation added.

The U-factors in this table are intended for use with metal building walls. This type of construction is typical for manufacturing and warehouse facilities, but is used for other building types as well. The typical method of insulating this type of building is to stretch vinyl backed fiberglass insulation over the metal girts before the metal siding is attached with metal screws. With this method, the insulation is compressed at each girt, reducing its effectiveness. The first part of the table contains values for this insulation technique. The second section of the table has data for systems that have two layers of insulation. In this section layers are listed from inside to outside.

For the majority of cases, values will be selected from column A of this table. Builders or designers may increase thermal performance by adding a rigid continuous insulation layer between the metal siding and the structural supports. When this table is used manually, the R-value of continuous insulation shall be equal to or greater than the R-value published in the continuous insulation columns. No interpolation is permitted when data from the table is used manually. CEC approved compliance software, however, may determine the U-factor for any amount of continuous insulation using Equation 4-1.

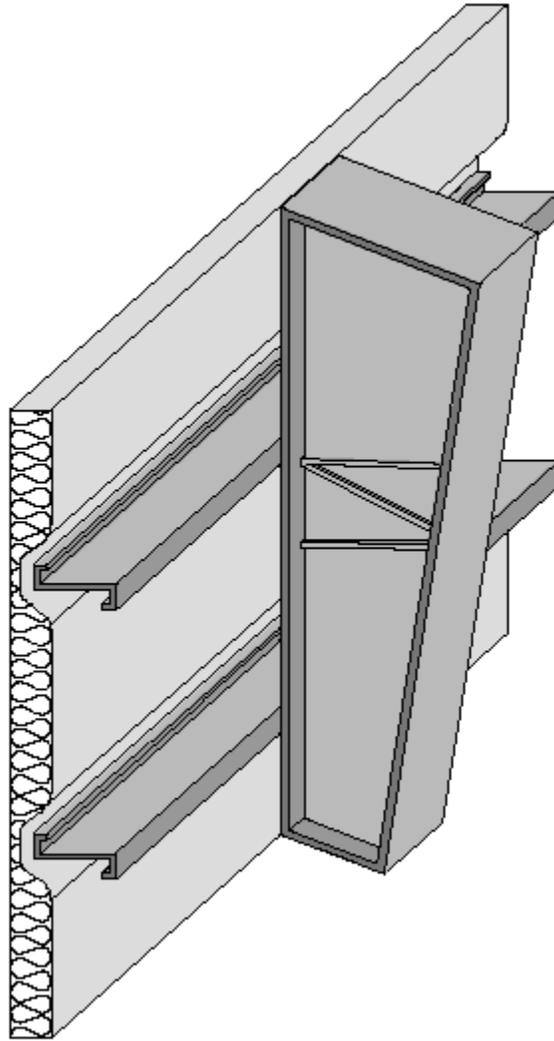


Figure 4.3.9 – Metal Building Wall

Assumptions: Data in Column A of this table is taken from the ASHRAE/IESNA Standard 90.1-2004, Appendix A. The data in columns beyond A are calculated using Equation 4-1.

Table 4.3.10 – U-factors for Insulated Metal Panel Walls

Panel Thickness	U-factor (Btu/°F-ft ²)	
	A	
2"	1	0.078
2 ½"	2	0.063
3"	3	0.053
4"	4	0.041
5"	5	0.033
6"	6	0.027

This table contains thermal performance data (U-factors) for foamed-in-place, insulated metal panels consisting of liquid polyurethane or polyisocyanurate injected between metal skins in individual molds or on fully automated production lines. Metal building construction is the most common application for this product where the metal panel is fastened to the frame of the structure. This table can only be used for insulated panels that are factory built. This table does not apply to panels that utilize polystyrene, or to field applied products such as spray applied insulations.

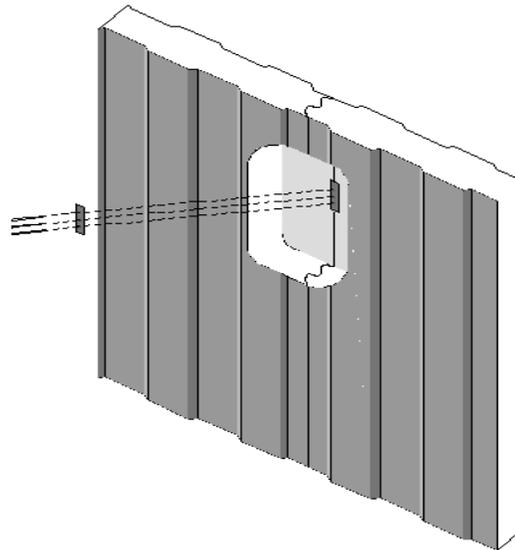


Figure 4.3.10 – Insulated Metal Panel Walls

Assumptions. These data are calculated using the parallel path method documented in the 2005-2009 ASHRAE Handbook of Fundamentals. These calculations assume an exterior air film of R-0.17, light gauge metal exterior of 0.0747 inch thickness, continuous insulation R-5.9 per inch, light gauge metal interior of 0.0747 inch thickness, interior air film (heat flow horizontal) of R-0.68. The panels are assumed to be continuous with no framing penetration. The R-value of the metal is negligible.

Table 4.3.11 – Thermal Properties of Log Home Walls

Log Diameter	U-factor		Heat Capacity (HC)
	A		
6"	1	0.133	4.04
8"	2	0.102	6.06
10"	3	0.083	6.73
12"	4	0.070	8.08
14"	5	0.060	9.42
16"	6	0.053	10.77

This table has U-factors and heat capacity data for log homes. Data is provided for logs in six thicknesses ranging from 6 in. to 16 in. If other thermal properties are needed such as density, weight, conductivity, etc., use the procedures in Modeling Constructions in the Nonresidential compliance software and contained in Section 4.6 of this document. CEC approved Compliance Software Programs may adjust the data for interior furring using data from Table 4.3.13 and the procedure from Equation 4-2.

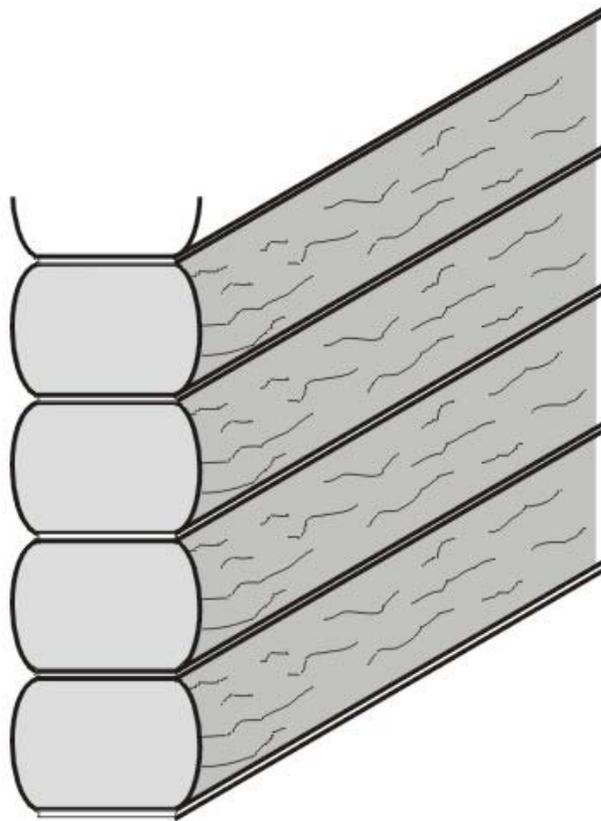


Figure 4.3.11 – Log Home Walls

Assumptions: Calculations are based on ASHRAE series method of calculation, 2005⁹ ASHRAE Handbook of Fundamentals. Values assume a log R-value of R-1.25/inch, an average wall thickness of 90 percent of the log diameter, an interior air film of R-0.68 and an exterior air film of R-0.17. Values do not account for presence of windows or doors. Construction assumes no additional siding or insulation. Heat Capacity is based on a hardwood density of 26.6 lb/ft³ and a specific heat of 0.39 Btu/lb-°F. An exterior air film of R-0.17 and an interior film of R-0.68 are assumed.

Table 4.3.12 – Thermal and Mass Properties of Straw Bale Walls

	1	A
R-value		30
U-factor		0.033
Heat Capacity[Btu/ft ² °F]		2.24

This table has data that may be used for straw bale construction. This is an alternative construction technique used in some rural areas. The technique is not commonly used for production homes.

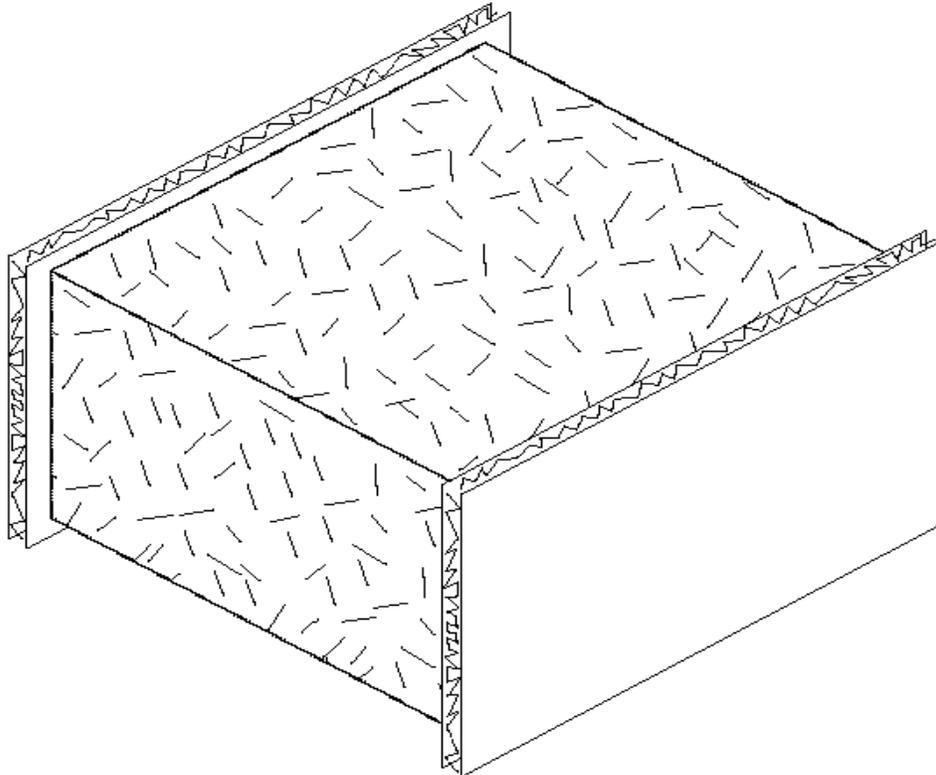


Figure 4.3.12 – Straw Bale Wall

Assumptions: The construction consists of an exterior film of R-0.17, stucco and lath of R-0.18, the straw bale, interior plaster of R-0.47, and an interior air film of 0.68. Straw bale must have a minimum cross section of 22 inch by 16 inch, and shall have a thermal resistance of R-30, whether stacked so the walls are 23 inch wide or 16 inch wide. Due to the higher resistance to heat flow across the grain of the straws, a bale laid on edge with a nominal 16 inch horizontal thickness has the same R-value (R-30) as a bale laid flat. Framing is assumed to not penetrate more than 25 percent of the way through the straw bale.

Table 4.3.13 – Effective R-values for Interior or Exterior Insulation Layers

Thick- ness	Frame Type	R-value of Insulation Installed in Furring Space																						
		0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	
		A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	
Any	None	1	0.5	1.5	2.5	3.5	4.5	5.5	6.5	7.5	8.5	9.5	10.5	11.5	12.5	13.5	14.5	15.5	16.5	17.5	18.5	19.5	20.5	21.5
0.5"	Wood	2	1.3	1.3	1.9	2.4	2.7	n.a.																
	Metal	3	0.9	0.9	1.1	1.1	1.2	n.a.																
0.75"	Wood	4	1.4	1.4	2.1	2.7	3.1	3.5	3.8	n.a.														
	Metal	5	1.0	1.0	1.3	1.4	1.5	1.5	1.6	n.a.														
1.0"	Wood	6	1.3	1.5	2.2	2.9	3.4	3.9	4.3	4.6	4.9	n.a.												
	Metal	7	1.0	1.1	1.4	1.6	1.7	1.8	1.8	1.9	1.9	n.a.												
1.5"	Wood	8	1.3	1.5	2.4	3.1	3.8	4.4	4.9	5.4	5.8	6.2	6.5	6.8	7.1	n.a.								
	Metal	9	1.1	1.2	1.6	1.9	2.1	2.2	2.3	2.4	2.5	2.6	2.6	2.7	n.a.									
2"	Wood	10	1.4	1.5	2.5	3.3	4.0	4.7	5.3	5.9	6.4	6.9	7.3	7.7	8.1	8.4	8.7	9.0	9.3	n.a.	n.a.	n.a.	n.a.	n.a.
	Metal	11	1.1	1.2	1.7	2.1	2.3	2.5	2.7	2.8	2.9	3.0	3.1	3.2	3.2	3.3	3.3	3.4	3.4	n.a.	n.a.	n.a.	n.a.	n.a.
2.5"	Wood	12	1.4	1.5	2.5	3.4	4.2	4.9	5.6	6.3	6.8	7.4	7.9	8.4	8.8	9.2	9.6	10.0	10.3	10.6	10.9	11.2	11.5	n.a.
	Metal	13	1.2	1.3	1.8	2.3	2.6	2.8	3.0	3.2	3.3	3.5	3.6	3.6	3.7	3.8	3.9	3.9	4.0	4.0	4.1	4.1	4.1	n.a.
3"	Wood	14	1.4	1.5	2.5	3.5	4.3	5.1	5.8	6.5	7.2	7.8	8.3	8.9	9.4	9.9	10.3	10.7	11.1	11.5	11.9	12.2	12.5	12.9
	Metal	15	1.2	1.3	1.9	2.4	2.8	3.1	3.3	3.5	3.7	3.8	4.0	4.1	4.2	4.3	4.4	4.4	4.5	4.6	4.6	4.7	4.7	4.8
3.5"	Wood	16	1.4	1.5	2.6	3.5	4.4	5.2	6.0	6.7	7.4	8.1	8.7	9.3	9.8	10.4	10.9	11.3	11.8	12.2	12.6	13.0	13.4	13.8
	Metal	17	1.2	1.3	2.0	2.5	2.9	3.2	3.5	3.8	4.0	4.2	4.3	4.5	4.6	4.7	4.8	4.9	5.0	5.1	5.1	5.2	5.2	5.3
4"	Wood	18	1.4	1.6	2.6	3.6	4.5	5.3	6.1	6.9	7.6	8.3	9.0	9.6	10.2	10.8	11.3	11.9	12.4	12.8	13.3	13.7	14.2	14.6
	Metal	19	1.2	1.3	2.0	2.6	3.0	3.4	3.7	4.0	4.2	4.5	4.6	4.8	5.0	5.1	5.2	5.3	5.4	5.5	5.6	5.7	5.8	5.8
4.5"	Wood	20	1.4	1.6	2.6	3.6	4.5	5.4	6.2	7.1	7.8	8.5	9.2	9.9	10.5	11.2	11.7	12.3	12.8	13.3	13.8	14.3	14.8	15.2
	Metal	21	1.2	1.3	2.1	2.6	3.1	3.5	3.9	4.2	4.5	4.7	4.9	5.1	5.3	5.4	5.6	5.7	5.8	5.9	6.0	6.1	6.2	6.3
5"	Wood	22	1.4	1.6	2.6	3.6	4.6	5.5	6.3	7.2	8	8.7	9.4	10.1	10.8	11.5	12.1	12.7	13.2	13.8	14.3	14.8	15.3	15.8
	Metal	23	1.2	1.4	2.1	2.7	3.2	3.7	4.1	4.4	4.7	5.0	5.2	5.4	5.6	5.8	5.9	6.1	6.2	6.3	6.5	6.6	6.7	6.8
5.5"	Wood	24	1.4	1.6	2.6	3.6	4.6	5.5	6.4	7.3	8.1	8.9	9.6	10.3	11.0	11.7	12.4	13.0	13.6	14.2	14.7	15.3	15.8	16.3
	Metal	25	1.3	1.4	2.1	2.8	3.3	3.8	4.2	4.6	4.9	5.2	5.4	5.7	5.9	6.1	6.3	6.4	6.6	6.7	6.8	7.0	7.1	7.2
EIFS		26	0.0	1.0	2.0	3.0	4.0	5.0	6.0	7.0	8.0	9.0	10.0	11.0	12.0	13.0	14.0	15.0	16.0	17.0	18.0	19.0	20.0	21.0

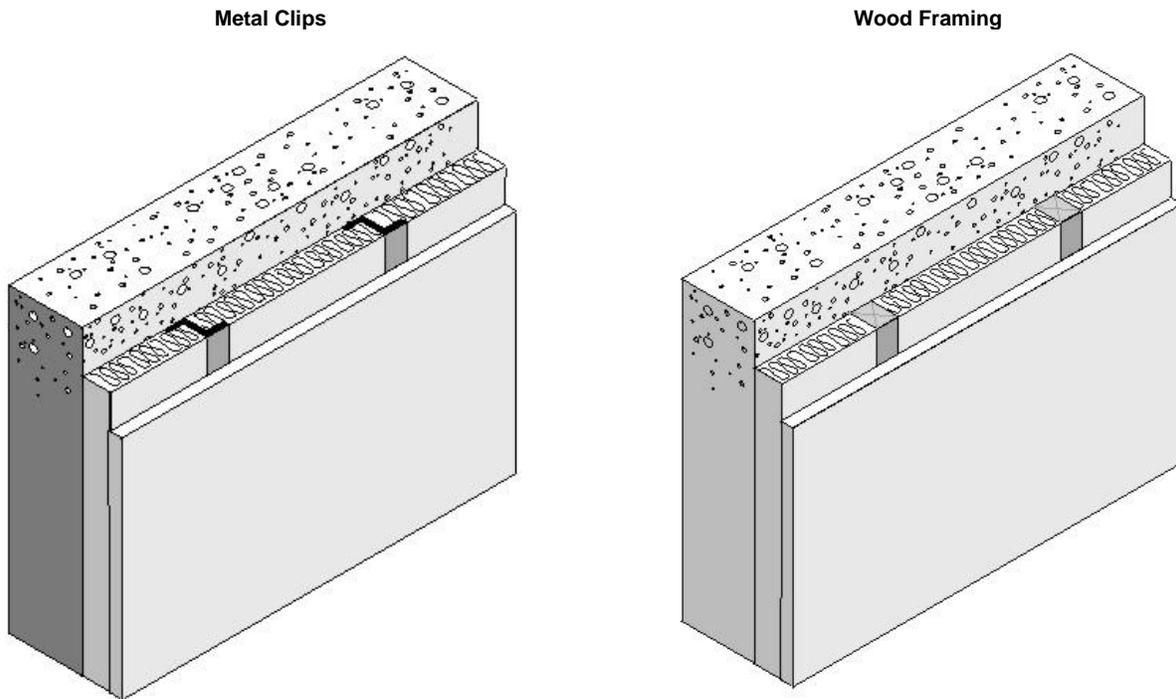


Figure 4.3.13 – Interior or Exterior Insulation Layers

This table is used in combination with other tables and Equation 4-1 and Equation 4-2 to account for interior furring and continuous insulation added to other constructions.

Assumptions: Data is taken from ASHRAE/IESNA Standard 90.1-2004 All furring thickness values given are actual dimensions. All values include 0.5 inch gypsum board on the inner surface, interior surface resistances not included. The metal furring is 24 inch on center, 24 gauge, Z-type Metal Furring. The wood furring is 24 inch on center, Douglas-Fir Larch Wood Furring, density = 34.9 lb/ft³. Insulation assumed to fill the furring space.

4.4 Floors and Slabs

Table 4.4.1 – Standard U-factors for Wood-Framed Floors with a Crawl Space

Framing Spacing	Nominal Framing Size	R-Value Cavity Insul.	Rated R-value of Continuous Insulation									
			R-0	R-2	R-4	R-6	R-7	R-8	R-10	R-14		
			A	B	C	D	E	F	G	H		
16 in. OC	Any 2 x 6	None	1	0.097	0.081	0.070	0.061	0.058	0.055	0.049	0.041	
		R-11	2	0.049	0.045	0.041	0.038	0.037	0.035	0.033	0.029	
		R-13	3	0.046	0.042	0.039	0.036	0.035	0.033	0.031	0.028	
		R-19	4	<u>0.037</u>	<u>0.034</u>	<u>0.032</u>	<u>0.030</u>	<u>0.029</u>	<u>0.029</u>	<u>0.027</u>	<u>0.024</u>	
	2 x 8	R-19	4	0.037	0.034	0.032	0.030	0.029	0.029	0.027	0.024	
		R-22	5	0.034	0.032	0.030	0.028	0.027	0.027	0.025	0.023	
	2 x 10	R-25	6	0.031	0.029	0.028	0.026	0.025	0.025	0.024	0.022	
		R-30	7	0.028	0.026	0.025	0.024	0.023	0.023	0.022	0.020	
	2 x 12	R-38	8	0.024	0.023	0.022	0.021	0.020	0.020	0.019	0.018	
	24 in. OC	Any 2 x 6	None	9	0.098	0.082	0.070	0.062	0.058	0.055	0.049	0.041
			R-11	10	0.049	0.045	0.041	0.038	0.036	0.035	0.033	0.029
			R-13	11	0.045	0.041	0.038	0.035	0.034	0.033	0.031	0.028
R-19			13	<u>0.037</u>	<u>0.034</u>	<u>0.032</u>	<u>0.030</u>	<u>0.029</u>	<u>0.028</u>	<u>0.027</u>	<u>0.024</u>	
2 x 8		R-19	12	0.036	0.034	0.032	0.030	0.029		0.028	0.027	0.024
		R-22	13	0.033	0.031	0.029	0.028	0.027		0.026	0.025	0.023
2 x 10		R-25	14	0.030	0.029	0.027	0.026	0.025		0.024	0.023	0.021
		R-30	15	0.027	0.026	0.024	0.023	0.023		0.022	0.021	0.020
2 x 12		R-38	16	0.023	0.022	0.021	0.020	0.020		0.020	0.019	0.017

Notes:

1. In order to use the U-factors listed in this section, exterior raised-floor insulation shall be installed between floor joists with a means of support that prevents the insulation from falling, sagging or deteriorating. Two approaches that accomplish this are:
2. Nailing insulation hangers 18 inches apart prior to rolling out the insulation. Hangers are heavy wires up to 48 inches long with pointed ends, which provide positive wood penetration.
3. Attaching wire mesh to form a basket between joists to support the insulation. Mesh is nailed or stapled to the underside of the joists.

This table contains U-factors for wood framed floors built over a ventilated crawlspace. This construction is common for low-rise residential buildings and for Type IV nonresidential buildings.

If continuous insulation is not used, then choices are made from Column A. In this case, the insulation is installed only between the framing members. Continuous insulation is not common for wood floors over a crawlspace, but if credit is taken, the insulation may be installed either above or below the framing members. The continuous insulation is typically a rigid polystyrene or polyisocyanurate foam insulation.

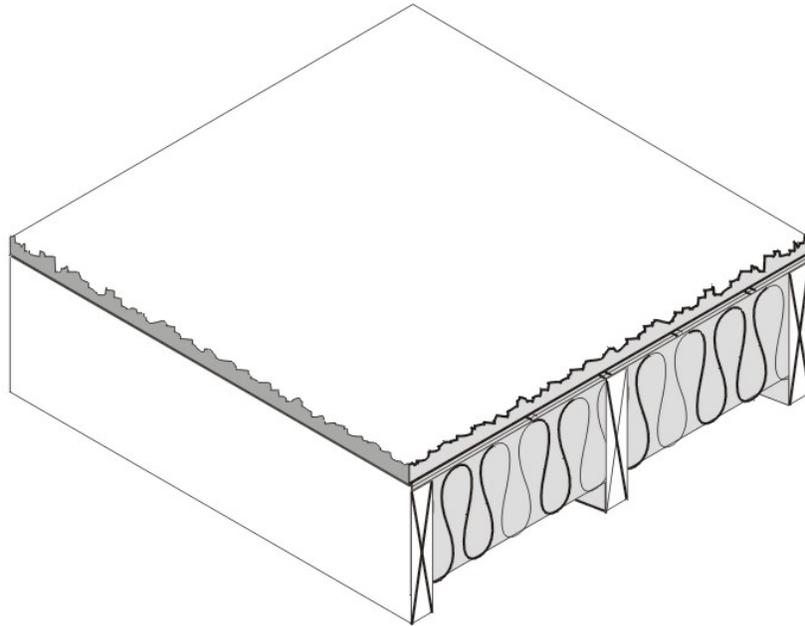


Figure 4.4.1 – Wood Framed Floor with a Crawl Space

When this table is used manually, the R-value of continuous insulation shall be equal to or greater than the R-value published in the continuous insulation columns. Continuous insulation of at least R-2 must exist in order to use columns B and beyond. No interpolation is permitted when data from the table is used manually. CEC approved compliance software, however, may determine the U-factor for any amount of continuous insulation or for unusual construction assemblies using Equation 4-1 and Equation 4-2.

If the crawlspace is not ventilated and is modeled as a controlled ventilation crawlspace (CVC), then values from this table shall not be used. Values from Table 4.21 shall be used instead and the crawlspace shall be modeled as a separate and unconditioned zone.

Assumptions: Calculations use the ASHRAE parallel heat flow method documented in the 2005 ASHRAE Handbook of Fundamentals. These calculations assume an exterior air film of R-0.17, a vented crawlspace for an effective R-6, a continuous insulation layer (if any), the insulation / framing layer, 5/8 inch wood based sheathing (Custom), carpet and pad of R-2.08 (CP01), and an interior air film (heat flow down) of R-0.92. The framing factor is assumed to be 10 percent for 16 inch stud spacing and 7 percent for 24 inch spacing.

Table 4.4.2 – Standard U-factors for Wood Framed Floors without a Crawl Space

Spacing	Nominal Framing Size	R-Value of Cavity Insul.		Rated R-value of Continuous Insulation							
				R-0	R-2	R-4	R-6	R-7	R-8	R-10	R-14
				A	B	C	D	E	F	G	H
16 in. OC	Any	None	1	0.238	0.161	0.122	0.098	0.089	0.082	0.070	0.055
	2 x 6 (5.50 in.)	R-11	2	0.071	0.062	0.055	0.050	0.047	0.045	0.041	0.036
		R-13	3	0.064	0.057	0.051	0.046	0.044	0.042	0.039	0.034
		R-19	4	<u>0.049</u>	<u>0.044</u>	<u>0.040</u>	<u>0.037</u>	<u>0.036</u>	<u>0.035</u>	<u>0.032</u>	<u>0.028</u>
	2 x 8 (7.25 in.)	R-19	54	0.048	0.044	0.040	0.037	0.036	0.035	0.033	0.029
		R-22	65	0.044	0.040	0.037	0.035	0.033	0.032	0.030	0.027
	2 x 10 (9.25 in.)	R-25	76	0.039	0.036	0.034	0.031	0.030	0.030	0.028	0.025
		R-30	87	0.034	0.032	0.030	0.028	0.028	0.027	0.025	0.023
	2 x 12 (11.25 in.)	R-38	98	0.029	0.027	0.026	0.024	0.024	0.023	0.022	0.020
24 in. OC	Any	None	910	0.243	0.163	0.123	0.099	0.090	0.083	0.071	0.055
	2 x 6 (5.50 in.)	R-11	110	0.070	0.061	0.054	0.049	0.047	0.045	0.041	0.035
		R-13	124	0.062	0.055	0.050	0.045	0.043	0.042	0.038	0.033
		R-19	13	<u>0.047</u>	<u>0.043</u>	<u>0.039</u>	<u>0.037</u>	<u>0.035</u>	<u>0.034</u>	<u>0.032</u>	<u>0.028</u>
	2 x 8 (7.25 in.)	R-19	142	0.047	0.043	0.039	0.037	0.035	0.034	0.032	0.028
		R-22	153	0.042	0.039	0.036	0.034	0.033	0.032	0.030	0.026
	2 x 10 (9.25 in.)	R-25	164	0.037	0.035	0.033	0.031	0.030	0.029	0.027	0.025
		R-30	175	0.033	0.031	0.029	0.027	0.027	0.026	0.025	0.022
	2 x 12 (11.25 in.)	R-38	186	0.027	0.026	0.025	0.023	0.023	0.022	0.021	0.020

This table contains U-factors for wood framed floors that are exposed to ambient (outdoor) conditions. This construction is common for low-rise residential buildings and for Type 4 nonresidential buildings.

If continuous insulation is not used, then choices are made from Column A. In this case, the insulation is installed only between the framing members. If credit is taken for continuous insulation, the insulation may be installed either above or below the framing members.

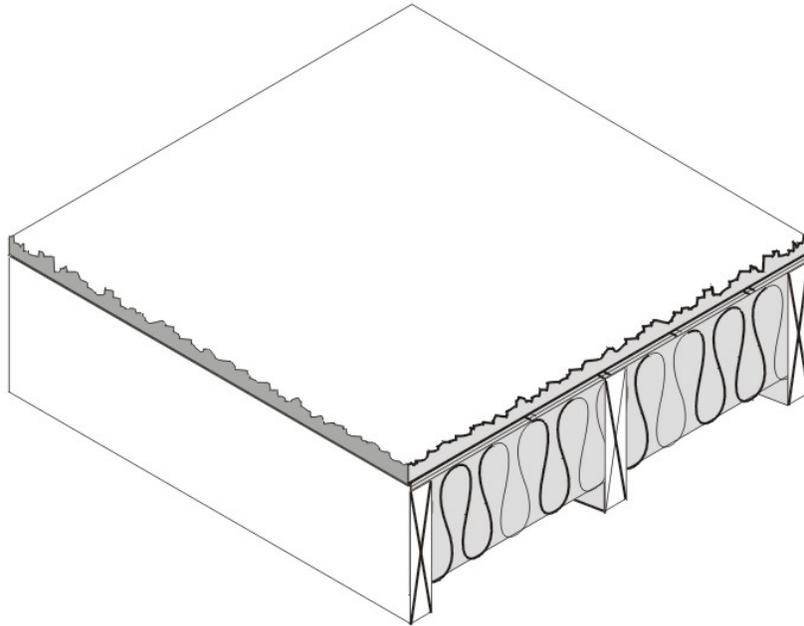


Figure 4.4.2 – Wood Framed Floor without a Crawl Space

When this table is used manually, the R-value of continuous insulation shall be equal to or greater than the R-value published in the continuous insulation columns. Continuous insulation of at least R-2 must exist in order to use data from columns B and beyond. No interpolation is permitted when data from the table is used manually. CEC approved compliance software, however, may determine the U-factor for any amount of continuous insulation or for unusual construction assemblies using Equation 4-1 and Equation 4-2.

Assumptions: Calculations use the ASHRAE parallel heat flow method documented in the 2005-2009 ASHRAE Handbook of Fundamentals. These calculations assume an exterior air film of R-0.17, a continuous insulation layer (if any), the cavity insulation / framing layer, 5/8 inch wood based sheathing (Custom), carpet and pad of R-2.08 (CP01), and an interior air film (heat flow down) of R-0.92.

Table 4.4.3 – Standard U-factors for Wood Foam Panel (SIP) Floors

Crawlspace	Insulation R-value ¹	Wood Framing Spline Connection Type (Splines)	Typical Panel Thickness		Rated R-value of Continuous Insulation ¹³						
					None	R-2	R-4	R-6	R-7	R-8	R-10
					A	B	C	D	E	F	G
Yes	R-22-14	Single 2x	4 1/2" 6.5 in	1	0.033 0.059	0.030 0.052	0.029 0.047	0.027 0.043	0.026 0.042	0.026 0.040	0.024 0.037
	R-22	Double 2x	6.5 in	2	0.034	0.031	0.029	0.028	0.027	0.026	0.025
	R-22	I-Joist	6.5 in	3	0.032	0.030	0.028	0.027	0.026	0.025	0.024
	R-28	Single 2x	8.25 in	4	0.027	0.026	0.024	0.023	0.023	0.022	0.021
	R-28 ²	Double 2x	8.25 in 6 1/2"	25	0.028 0.042	0.026 0.038	0.025 0.036	0.024 0.033	0.023 0.032	0.023 0.031	0.022 0.029
	R-28	I-Joist	8.25 in 8 1/4"	36	0.027 0.033	0.025 0.031	0.024 0.029	0.023 0.028	0.022 0.027	0.022 0.026	0.021 0.025
	R-36 ²	Single 2x	6.5 in 40 1/4"	47	0.024 0.027	0.023 0.026	0.022 0.024	0.021 0.023	0.021 0.023	0.020 0.022	0.019 0.022
	R-33 ² R-33	Double 2x	6.5 in	8	0.026	0.024	0.023	0.022	0.021	0.021	0.020
	R-33 ² R-33	I-Joist	6.5 in	9	0.024	0.023	0.022	0.021	0.020	0.020	0.019
	R-36	Single 2x	10.25 in	10	0.023	0.022	0.021	0.020	0.019	0.019	0.018
	R-36	Double 2x	10.25 in	11	0.024	0.022	0.021	0.020	0.020	0.020	0.019
	R-36	I-Joist	10.25 in	12	0.022	0.021	0.020	0.019	0.019	0.019	0.018
Yes	R-22 R-14	Single 2x	6.5 in 4 1/2"	135	0.041 0.043	0.038 0.040	0.035 0.037	0.033 0.034	0.031 0.033	0.030 0.032	0.029 0.030
	R-22	Double 2x	6.5 in	14	0.043	0.039	0.036	0.034	0.032	0.031	0.029
	R-22	I-Joist	6.5 in	15	0.040	0.037	0.034	0.032	0.031	0.030	0.028
	R-28	Single 2x	8.25 in	16	0.033	0.030	0.029	0.027	0.026	0.026	0.024
	R-28	Double 2x	8.25 in	17	0.034	0.032	0.030	0.028	0.027	0.026	0.025
	R-28	I-Joist	8.25 in	18	0.032	0.030	0.028	0.027	0.026	0.025	0.024
	R-33 ²	Single 2x	6.5 in	19	0.029	0.027	0.026	0.024	0.024	0.023	0.022
	R-33 ²	Double 2x	6.5 in	20	0.032	0.029	0.027	0.026	0.025	0.024	0.023
	R-33 ²	I-Joist	6.5 in	21	0.028	0.027	0.025	0.024	0.023	0.023	0.022
	R-36	Single 2x	10.25 in	22	0.026	0.025	0.024	0.023	0.022	0.022	0.021
	R-36 R-22	Double 2x	10.25 in 6 1/2"	236	0.028 0.033	0.026 0.031	0.025 0.029	0.024 0.027	0.023 0.027	0.022 0.026	0.021 0.025
	R-36 R-28	I-Joist	10.25 in 8 1/4"	247	0.026 0.027	0.024 0.026	0.023 0.025	0.022 0.023	0.021 0.023	0.021 0.022	0.020 0.022

Notes:

1. The insulation R-value must be at least R-21.7 in order to use this table. This table assumes moulded expanded polystyrene (EPS) unless noted otherwise. Although other insulation types are used by some SIP manufacturers, such as polyurethane and extruded expanded insulation (XPS), EPS is the most common insulation used in SIP construction.

2. R-33.2 is achievable using polyurethane insulation in 6.5" panels.

3. Continuous insulation shall be at least R-2 and may be installed on either the inside or the exterior of the roof/ceiling. For credit, continuous insulation shall be at least R-2 and may be installed on either the inside or the exterior of the wall.

Structural insulated panels (SIPs) consist of a rigid insulation core, securely bonded between two structural facings, to form a structural sandwich panel. SIPs are considered a non-framed assembly usually with little or no structural framing that penetrates the insulation layer, resulting in less thermal bridging across the insulation when compared to a conventional framed assembly. This table gives U-factors for structurally insulated panels used in floor construction. This is a construction system that consists of rigid foam insulation sandwiched

~~between two layers of plywood or oriented strand board (OSB). For floors 2x wood spacers are assumed to separate the OSB panels and carry the floor load.~~

If continuous insulation is not used, then choices are made from Column A. When continuous insulation is also used, this is typically installed on the exterior side of the floor, but can also be used on the inside. The continuous insulation is typically a rigid polystyrene or polyisocyanurate foam insulation.

When this table is used manually, the R-value of continuous insulation shall be equal to or greater than the R-value published in the continuous insulation columns. Continuous insulation of at least R-2 must exist in order to use this table. CEC approved compliance software, however, may determine the U-factor for any amount of continuous insulation or for unusual construction assemblies using Equation 4-1 and Equation 4-2.

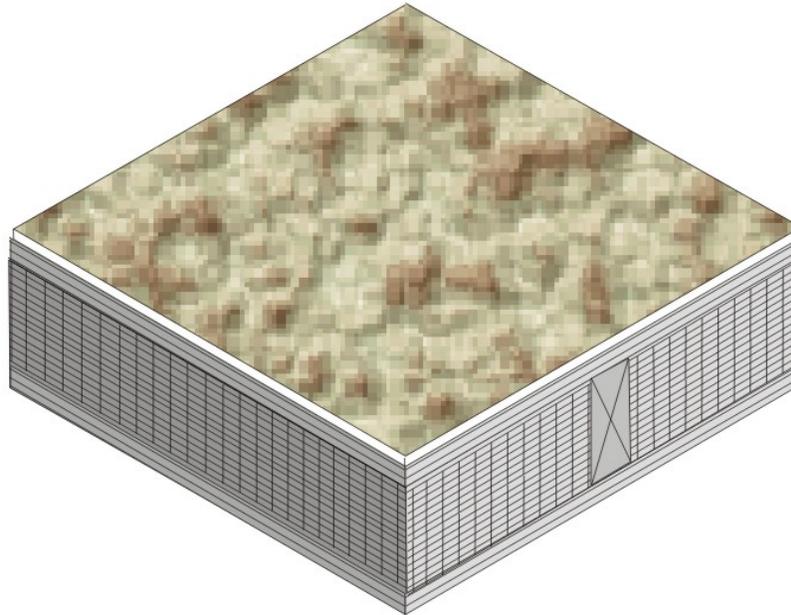


Figure 4.4.3 – Wood Foam Panel (SIP) Floor

Assumptions: These data are calculated using the parallel path method documented in the 2005-2009 ASHRAE Handbook of Fundamentals. These calculations assume an exterior air film of R-0.17, a vented crawlspace of R-6, 7/16 inch of OSB at R-0.44, framing factor of 2, 7/16 inch of OSB, carpet and pad of R-2.08 and an interior air film of R-0.92. ~~assume an exterior air film of R-0.17, a vented crawlspace with an effective R-6, 7/16 inch of OSB of R-0.44, the insulation / framing layer, 7/16 inch of OSB, carpet and pad of R-2.08 (CP01) and an interior air film (heat flow down) of R-0.92. Calculations assume a 2x framing spline every 4 foot on center. Framing section assumes an exterior air film of R-0.17, a vented crawlspace of R-6, 7/16 inch of OSB at R-0.44, 2x framing, 7/16 inch of OSB, carpet and pad of R-2.08 (CP01) and an interior air film of R-0.92.~~

Table 4.4.4 – Standard U-factors for Metal-Framed Floors with a Crawl Space

Framing Spacing	Nominal Framing Size	Cavity Insulation R-Value:	Rated R-value of Continuous Insulation								
			R-0	R-2	R-4	R-6	R-7	R-8	R-10	R-14	
			A	B	C	D	E	F	G	H	
16 in. OC	Any	None	1	0.094	0.079	0.068	0.060	0.057	0.054	0.048	0.041
	2 x 6	R-11	2	0.065	0.058	0.052	0.047	0.045	0.043	0.039	0.034
		R-13	3	0.063	0.056	0.050	0.046	0.044	0.042	0.039	0.033
		R-19	4	0.059	0.053	0.048	0.044	0.042	0.040	0.037	0.032
	2 x 8	R-19	5	0.058	0.052	0.047	0.043	0.041	0.040	0.037	0.032
		R-22	6	0.056	0.050	0.046	0.042	0.040	0.039	0.036	0.031
	2 x 10	R-30	7	0.051	0.046	0.042	0.039	0.038	0.036	0.034	0.030
	2 x 12	R-38	8	0.048	0.044	0.040	0.037	0.036	0.035	0.032	0.029
24 in. OC	Any	None	9	0.094	0.079	0.068	0.060	0.057	0.054	0.048	0.041
	2 x 6	R-11	10	0.061	0.054	0.049	0.045	0.043	0.041	0.038	0.033
		R-13	11	0.058	0.052	0.047	0.043	0.041	0.040	0.037	0.032
		R-19	12	0.053	0.048	0.044	0.040	0.039	0.037	0.035	0.030
	2 x 8	R-19	13	0.051	0.046	0.042	0.039	0.038	0.036	0.034	0.030
		R-22	14	0.049	0.045	0.041	0.038	0.036	0.035	0.033	0.029
	2 x 10	R-30	15	0.045	0.041	0.038	0.035	0.034	0.033	0.031	0.028
	2 x 12	R-38	16	0.041	0.038	0.035	0.033	0.032	0.031	0.029	0.026

Notes:

In order to use the U-factors listed in this table, exterior raised-floor insulation shall be installed between floor joists with a means of support that prevents the insulation from falling, sagging or deteriorating. Two approaches that accomplish this are:

- Attaching insulation hangers 18 inches apart prior to rolling out the insulation. Hangers are heavy wires up to 48 inches long with pointed ends.
- Attaching wire mesh to form a basket between joists to support the insulation. Mesh is nailed or stapled to the underside of the joists.

This table contains U-factors for metal-framed floors built over a crawlspace. The constructions represented are similar to those in Table 4.4.1, except that wood framing is replaced with metal framing. Cavity insulation is installed between the framing members. Since the steel is not as large a cross section as wood, the insulation needs to be wider than that used with wood to fit in between the steel framing members.

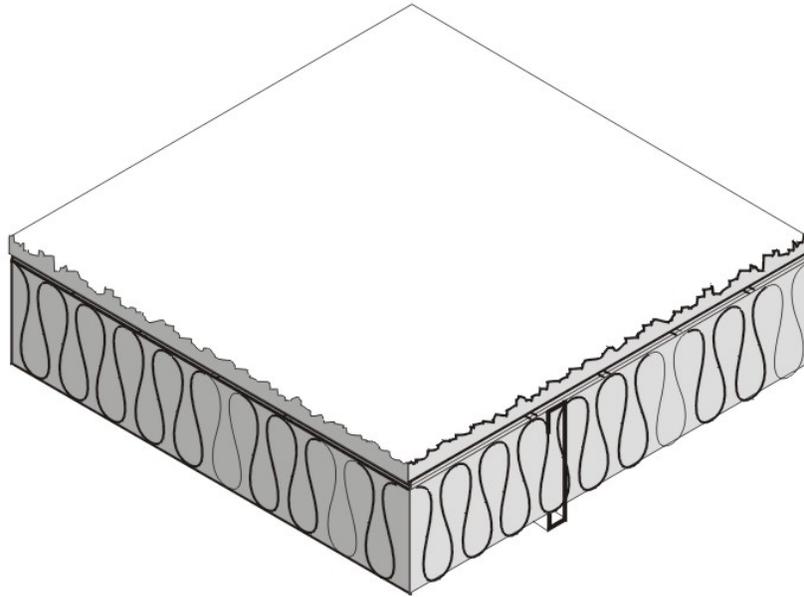


Figure 4.4.4 – Metal Framed Floors with a Crawl Space

For the majority of cases, values will be selected from column A of this table. Column A applies for the common situation where batt insulation is supported between framing members. Builders or designers may increase thermal performance by adding a continuous insulation layer either above or below the framing members.

When this table is used manually, the R-value of continuous insulation shall be equal to or greater than the R-value published in the continuous insulation columns. No interpolation is permitted when data from the table is used manually. CEC approved compliance software, however, may determine the U-factor for any amount of continuous insulation and for unusual construction layers using Equation 4-1 and Equation 4-2.

Assumptions: Calculations are based on the ASHRAE Zone Method Calculation, 2005-2009 ASHRAE Handbook of Fundamentals. These calculations assume an exterior air film of R-0.17, a vented crawlspace for an effective R-6, a continuous insulation layer (if any), the insulation / framing layer, 5/8 inch wood based sheathing (Custom), carpet and pad of R-2.08 (CP01), and an interior air film (heat flow down) of R-0.92. The effect of the crawlspace is approximated by an additional R-6 of insulation. The internal default framing percentages are 10 percent for 16 inch on center and 7 percent for 24 inch on center. Steel Framing has a 1.5 inch flange and is 0.075 inch thick steel (14 gauge) with no knockouts. U-factors are calculated using EZ frame 2.0.

Table 4.4.5 – Standard U-factors for Metal-Framed Floors without a Crawl Space

Spacing	Nominal Framing Size	Cavity Insulation R-Value	Rated R-value of Continuous Insulation								
			R-0	R-2	R-4	R-6	R-7	R-8	R-10	R-14	
			A	B	C	D	E	F	G	H	
16 in. OC	Any	None	1	0.253	0.168	0.126	0.100	0.091	0.084	0.072	0.056
	2 x 6	R-11	2	0.108	0.089	0.075	0.066	0.062	0.058	0.052	0.043
		R-13	3	0.102	0.085	0.072	0.063	0.060	0.056	0.050	0.042
		R-19	4	0.092	0.078	0.067	0.059	0.056	0.053	0.048	0.040
	2 x 8	R-19	5	0.088	0.075	0.065	0.058	0.054	0.052	0.047	0.039
		R-22	6	0.085	0.073	0.063	0.056	0.053	0.051	0.046	0.039
	2 x 10	R-30	7	0.075	0.065	0.058	0.052	0.049	0.047	0.043	0.037
	2 x 12	R-38	8	0.068	0.060	0.053	0.048	0.046	0.044	0.040	0.035
24 in. OC	Any	None	9	0.253	0.168	0.126	0.100	0.091	0.084	0.072	0.056
	2 x 6	R-11	10	0.095	0.080	0.069	0.061	0.057	0.054	0.049	0.041
		R-13	11	0.087	0.074	0.065	0.057	0.054	0.051	0.047	0.039
		R-19	12	0.077	0.067	0.059	0.053	0.050	0.048	0.044	0.037
	2 x 8	R-19	13	0.074	0.064	0.057	0.051	0.049	0.046	0.043	0.036
		R-22	14	0.07	0.061	0.055	0.049	0.047	0.045	0.041	0.035
	2 x 10	R-30	15	0.061	0.054	0.049	0.045	0.043	0.041	0.038	0.033
	2 x 12	R-38	16	0.054	0.049	0.044	0.041	0.039	0.038	0.035	0.031

Notes:

In order to use the U-factors listed in this section, exterior raised-floor insulation shall be installed between floor joists with a means of support that prevents the insulation from falling, sagging or deteriorating. Two approaches that accomplish this are:

- Attaching insulation hangers 18 inches apart prior to rolling out the insulation. Hangers are heavy wires up to 48 inches long with pointed ends.
- Attaching wire mesh to form a basket between joists to support the insulation. Mesh is nailed or stapled to the underside of the joists.

This table contains U-factors for metal-framed floors built over outdoor conditions. For the majority of cases, values will be selected from column A of this table. Column A applies for the common situation where batt insulation is supported between framing members. Builders or designers may increase thermal performance by adding a continuous insulation layer either above or below the framing members.

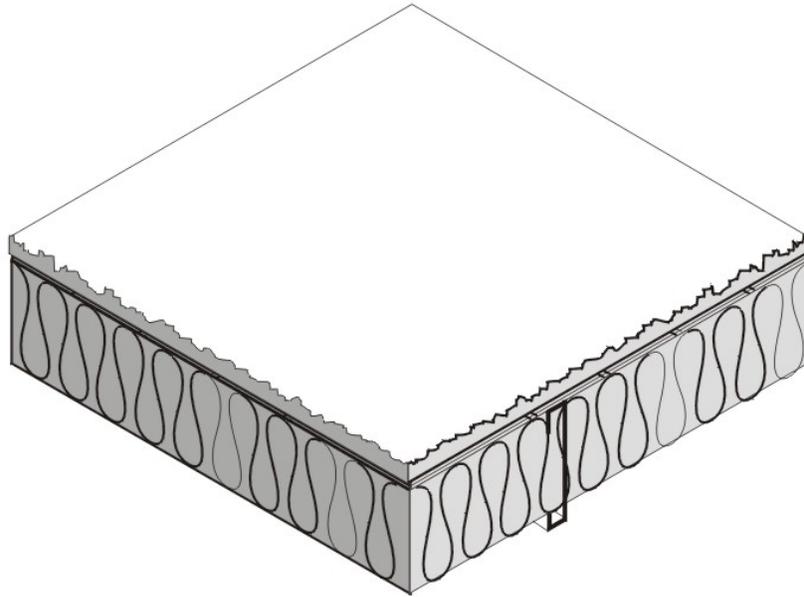


Figure 4.4.5 – Metal Framed Floors without a Crawl Space

When this table is used manually, the R-value of continuous insulation shall be equal to or greater than the R-value published in the continuous insulation columns. No interpolation is permitted when data from the table is used manually. CEC approved compliance software, however, may determine the U-factor for any amount of continuous insulation and for unusual construction layers using Equation 4-1 and Equation 4-2.

Assumptions: Calculations are based on the ASHRAE Zone Method Calculation, 2005-2009 ASHRAE Handbook of Fundamentals Handbook. These calculations assume an exterior air film of R-0.17, a continuous insulation layer (if any), the insulation / framing layer, 5/8 inch wood based sheathing (Custom), carpet and pad of R-2.08 (CP01), and an interior air film (heat flow down) of R-0.92. The internal default framing percentages are 10 percent for 16 inch on center and 7 percent for 24 inch on center. Steel Framing has a 1.5 inch flange and is 0.075 inch thick steel with no knockouts. U-factors calculated using EZ frame 2.0.

Table 4.4.6 – Standard U-factors for Concrete Raised Floors

R-value of Insulation	Rated R-value of Continuous Insulation		
	Continuous Insulation Underneath	Continuous Insulation Above Deck ¹ with no Sleepers	Continuous Insulation Above Deck ¹ with Sleepers
	A	B	C
R-0	1	0.269	0.229
R-2	2	0.183	0.157
R-4	3	0.138	0.120
R-6	4	0.111	0.097
R-8	5	0.092	0.081
R-10	6	0.079	0.070
R-12	7	0.069	0.061
R-15	8	0.058	0.052
R-20	9	0.045	0.041
R-25	10	0.037	0.034
R-30	11	0.031	0.029

Notes:

¹ Above deck case includes a 5/8 inch layer of plywood between the insulation and the carpet and pad.
 This table may be used only if the HC of the proposed design floor is greater than or equal to 7.0 Btu/ft²·°F.

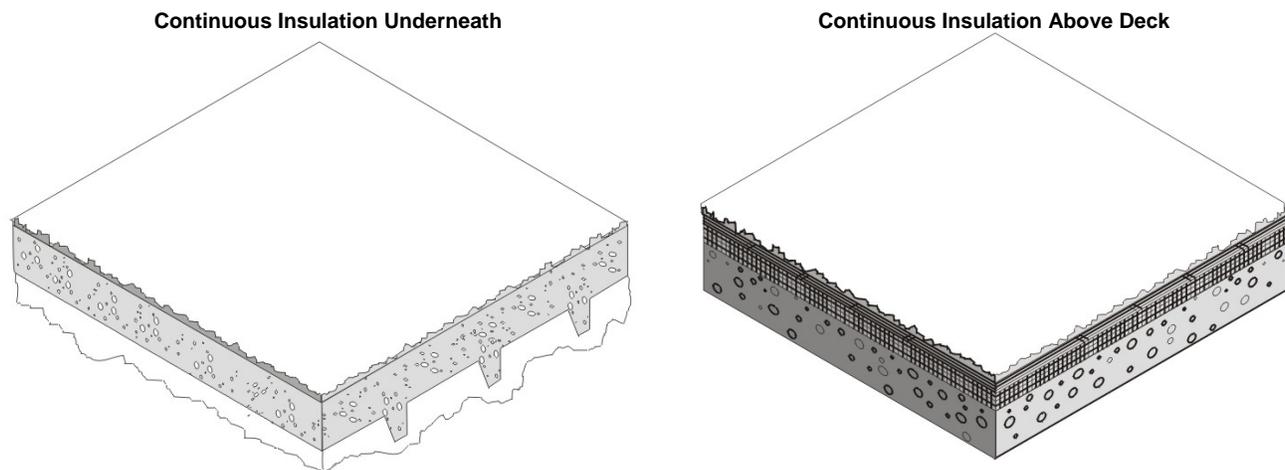


Figure 4.4.6 – Concrete Raised Floors

Assumptions: These calculations assume an exterior air film of R-0.17, a continuous insulation layer (if any), 4 inches of the lightweight concrete (CC14) over metal deck R-0, a continuous insulation layer (if any), 1.5 x 3.5 inch sleeper of R-0.99 per inch, R-0.80 air space between sleepers (2005 ASHRAE Handbook of Fundamentals, Chapter 25, Table 3), 5/8 inches of wood based sheathing (Custom) (if continuous insulation above deck), carpet and pad of R-2.08 (CP01), and an interior air film (heat flow down) of R-0.92. Sleepers have 10 percent framing factor. Below slab insulation assumes 6 inch wide beams 96 inches on center extending 8 inches below the slab.

Table 4.4.7 – F-Factors for Unheated Slab-on-Grade Floors

Insulation Description		Rated R-Value of Insulation												
		R-0	R-5	R-7.5	R-10	R-15	R-20	R-25	R-30	R-35	R-40	R-45	R-50	R-55
		A	B	C	D	E	F	G	H	I	J	K	L	M
None	1	0.73												
12 in. horizontal	2		0.72	0.71	0.71	0.71								
24 in. horizontal	3		0.70	0.70	0.70	0.69								
36 in. horizontal	4		0.68	0.67	0.66	0.66								
48 in. horizontal	5		0.67	0.65	0.64	0.63								
12 in. vertical	6		0.61	0.60	0.58	0.57	0.567	0.565	0.564					
24 in. vertical	7		0.58	0.56	0.54	0.52	0.510	0.505	0.502					
36 in. vertical	8		0.56	0.53	0.51	0.48	0.472	0.464	0.460					
48 in. vertical	9		0.54	0.51	0.48	0.45	0.434	0.424	0.419					
Fully insulated slab	10		0.46	0.41	0.36	0.30	0.261	0.233	0.213	0.198	0.186	0.176	0.168	0.161

Note: These values are used for slab edge conditions with and without carpet.

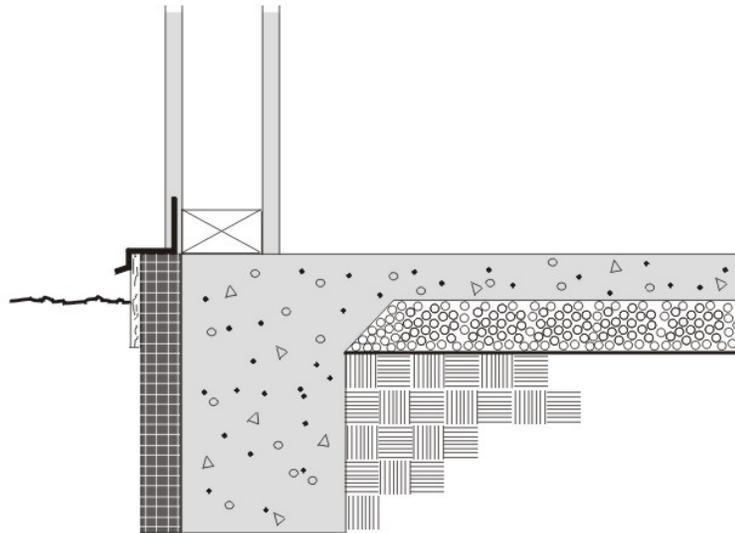


Figure 4.4.7 – Unheated Slab-on-Grade Floor

Horizontal insulation is continuous insulation that is applied directly to the underside of the slab and extends inward horizontally from the perimeter for the distance specified or continuous insulation that is applied downward from the top of the slab and then extends horizontally to the interior or the exterior from the perimeter for the distance specified. *Vertical insulation* is continuous insulation that is applied directly to the slab exterior, extending downward from the top of the slab for the distance specified. *Fully insulated slab* is continuous insulation that extends downward from the top to the slab and along the entire perimeter and completely covers the entire area under the slab.

Assumptions: Data of this table is taken from the ASHRAE/IESNA Standard 90.1-2004, Appendix A.

Table 4.4.8 – F-Factors for Heated Slab-on-Grade Floors

		Rated R-Value of Insulation												
		R-0	R-5	R-7.5	R-10	R-15	R-20	R-25	R-30	R-35	R-40	R-45	R-50	R-55
		A	B	C	D	E	F	G	H	I	J	K	L	M
None	11	1.35												
12 in. horizontal	12		1.31	1.31	1.30	1.30								
24 in. horizontal	13		1.28	1.27	1.26	1.25								
36 in. horizontal	14		1.24	1.21	1.20	1.18								
48 in. horizontal	15		1.20	1.17	1.13	1.11								
12 in. vertical	16		1.06	1.02	1.00	0.98	0.968	0.964	0.961					
24 in. vertical	17		0.99	0.95	0.90	0.86	0.843	0.832	0.827					
36 in. vertical	18		0.95	0.89	0.84	0.79	0.762	0.747	0.740					
48 in. vertical	19		0.91	0.85	0.78	0.72	0.688	0.671	0.659					
Fully insulated slab	20		0.74	0.64	0.55	0.44	0.373	0.326	0.296	0.273	0.255	0.239	0.227	0.217

Note: These values are used for slab edge conditions with and without carpet.

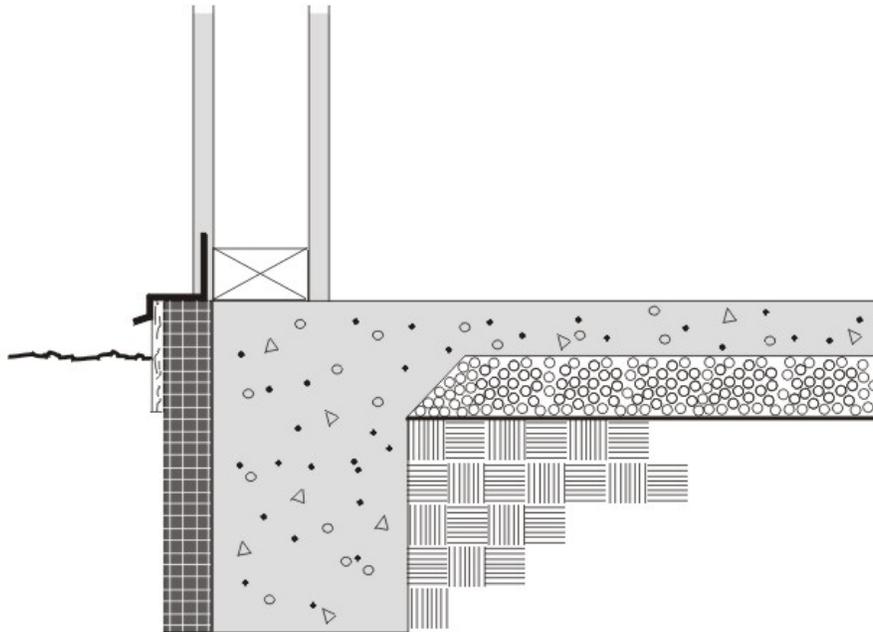


Figure 4.4.8 – Heated Slab-on-Grade Floor

Horizontal insulation is continuous insulation that is applied directly to the underside of the slab and extends inward horizontally from the perimeter for the distance specified or continuous insulation that is applied downward from the top of the slab and then extending horizontally to the interior or the exterior from the perimeter for the distance specified. *Vertical insulation* is continuous insulation that is applied directly to the slab exterior, extending downward from the top of the slab for the distance specified. *Fully insulated slab* is continuous insulation that extends downward from the top to the slab and along the entire perimeter and completely covers the entire area under the slab.

Assumptions: Data of this table is taken from the ASHRAE/IESNA Standard 90.1-2004, Appendix A.

4.5 Miscellaneous Construction

Table 4.5.1 – Opaque Doors

Description	U-factor (Btu/°F-ft ²)	
		A
Uninsulated single-layer metal <i>swinging doors</i> or <i>non-swinging doors</i> , including single-layer uninsulated access hatches and uninsulated smoke vents:	1	1.45
Uninsulated double-layer metal <i>swinging doors</i> or <i>non-swinging doors</i> , including double-layer uninsulated access hatches and uninsulated smoke vents:	2	0.70
Insulated metal <i>swinging doors</i> , including fire-rated <i>doors</i> , insulated access hatches, and insulated smoke vents:	3	0.50
Wood <i>doors</i> , minimum nominal thickness of 1-3/4 in. (44 mm), including panel <i>doors</i> with minimum panel thickness of 1-1/8 in. (28 mm), and solid core flush <i>doors</i> , and hollow core flush <i>doors</i> :	4	0.50
Any other wood <i>door</i> :	5	0.60
Uninsulated single layer metal <i>roll up doors</i> including fire rated <i>door</i>	6	1.45
Insulated single layer metal <i>sectional doors</i> , minimum insulation nominal thickness of 1-3/8 inch; expanded polystyrene (R-4 per inch).	7	0.179

Source: ASHRAE 90.1-2004~~2004~~2007, Section A7.

4.6 Modeling Constructions in the Nonresidential Compliance Software

DOE-2.1e is the reference method for nonresidential compliance software. CALRES is the reference method for residential compliance software. These programs and other approved compliance software may require additional information on the physical properties of materials. With DOE-2, specifying the layers that make up the assembly and defining the fundamental thermal properties for each layer such as thickness, conductivity, density and specific heat may define construction assemblies. CALRES and its derivatives require density, conductivity and volumetric heat capacity and unit interior mass capacity (UIMC). These properties are related to each other so that if you know some of the properties you can calculate the others.

4.6.1 DOE-2 Material Codes

Notes to each of the tables in this joint appendix describe the layers that are used to determine the U-factors. The codes in parenthesis are a reference to the DOE-2 material codes used in the calculations. These codes along with other materials referenced in the notes are shown below. Some of the materials that are used in the standard construction assemblies are not listed as standard DOE-2 materials and in these cases, the "Code" column is shown as "Custom".

4.6.2 Framing/Insulation Layer

With the DOE-2 model, every layer is assumed to be homogeneous, while in reality this is not the case. Framed walls have a layer that includes the framing members with insulation placed between the members. With DOE-2, the layers specified in the footnotes shall be entered and the R-value of insulation/framing layer shall be back calculated to achieve the U-factor shown in the tables in this appendix. The insulation/framing layer shall be modeled with an R-value (no mass), as opposed to entering conductivity, specific heat, density and thickness for the framing layer.

4.6.3 Thermal Mass Properties

When U-factor, C-factor and HC are published, other thermal mass properties may be calculated using the rules described in Table 4.6.2.

4.6.4 Metal Buildings

Metal building walls and metal building roofs shall be modeled in the DOE-2 reference method as quick surfaces, e.g. thermal mass is not modeled. In these cases, no layers are specified, just the U-factor.

4.6.5 Slabs

For nonresidential buildings, slab edge conditions shall be modeled as 12 in. of concrete and 12 in. of earth, and a layer of insulation exterior to the earth that achieves the F-factors shown in Table 4.4.7 and Table 4.4.8.

Table 4.6.1 – Physical Properties of Materials

Code	Description	R-value	Thickness	Conductivity	Density	Specific Heat
AR02	Asphalt Shingle & Siding	0.44			70.0	0.35
BP01	Building Paper, Permeable Felt	0.06				
PW03	Plywood 1/2 in.	0.63	0.0417	0.0667	34.0	0.29
GP01	Gypsum Board 1/2 in.	0.45	0.0417	0.0926	50.0	0.26
BR01	Built-up Roofing 3/8 in.	0.33	0.0313	0.0939	70.0	0.35
PW05	Plywood 3/4 in.	0.94	0.0625	0.0667	34.0	0.29
PW04	Plywood 5/8 in.	0.78	0.0521	0.0667	34.0	0.29
CP01	Carpet with Fibrous Pad	2.08				0.34
PB01	Particle Board Low Density 3/4 in.	1.39	0.0625	0.0450	75.0	0.31
SC01	Stucco 1 in.	0.20	0.0833	0.4167	116.0	0.20
WD05	Wood, Soft 4 in.	5.00	0.3333	0.0667	32.0	0.33
WD11	Wood, Hard 3/4 in.	0.68	0.0625	0.0916	45.0	0.30
-CC03	Heavy Wt. Dried Aggregate 4 in.	0.44	0.3333	0.7576	140.0	0.20
CC14	Heavy Wt. Undried Aggregate 4 in.	0.32	0.3333	1.0417	140.0	0.20
AC02	1/2 in. Acoustic Tile	1.26	0.0417	0.0330	18.0	0.32
AL33	Air Layer 4 in. or more, Horizontal Roof	0.92	1.0000	0.4167	120.0	0.20
CP01	Carpet with Fibrous Pad	2.08				0.34
Custom	Concrete	0.11			144.0	0.20
Custom	Light weight CMU	0.35			105.0	0.20
Custom	Medium Weight CMU	0.35			115.0	0.20
Custom	Normal Weight CMU	0.35			125.0	0.20
Custom	Earth (Soil)	3.00	1.5000	0.5000	85.0	0.20
Custom	Logs 6 in.	7.50	0.5000	0.0667	32.0	0.33
Custom	Logs 8 in.	10.00	0.6667	0.0667	32.0	0.33
Custom	Logs 10 in.	12.49	0.8333	0.0667	32.0	0.33
Custom	Logs 12 in.	14.99	1.0000	0.0667	32.0	0.33
Custom	Logs 14 in.	17.49	1.1667	0.0667	32.0	0.33
Custom	Logs 16 in.	19.99	1.3333	0.0667	32.0	0.33
Custom	Earth 12 in.	2.00	1.0000	0.5000	85.0	0.20
Custom	Vented crawspace	6.00	NA	NA	NA	NA
Custom	7/8" layer of stucco of R-0.18	0.18	0.0729	0.4167	116.0	0.20
Custom	Straw bale	30.00				
Custom	Acoustic tile + Metal	0.50	0.0417	0.0330	18.0	0.32
Custom	OSB 7/16 in.	0.44	0.4375	0.0667	34.0	0.29

Table 4.6.2 – Rules for Calculating Mass Thermal Properties From Published Values

Property	Units	Rule for Calculation
Heat Capacity (HC)	Btu/°F-ft ²	From Table 4.3.5, Table 4.3.6, or Table 4.3.7
U-factor	Btu/h-°F-ft ²	From Table 4.3.5, Table 4.3.6, or Table 4.14
C-factor	Btu/h-°F-ft ²	From Table 4.3.5, Table 4.3.6, or Table 4.3.7
Thickness (T)	Ft	From Table 4.3.5, Table 4.3.6, or Table 4.3.7
Specific Heat (SH)	Btu/°F-lb	Assume that the specific heat of all concrete and masonry materials is 0.20 Btu/°F-lb and that the specific heat of wood or straw (see Table 4.3.11 and Table 4.3.12) is 0.39 Btu/°F-lb.
Weight (W)	lb/ft ²	Divide the HC by the assumed specific heat. Wall weight is used with the low-rise residential standards to define a high mass wall.
Density (D)	lb/ft ³	Multiply the weight (as calculated above) by the thickness (T)
Conductivity (C)	Btu/h-°F-ft	Divide the published C-factor by the thickness (T). When only a U-factor is published, calculate the C-factor by assuming an exterior air film of 0.17 and an interior air film of 0.68.

Joint Appendix JA5

Appendix JA5 - Technical Specifications For Upgradeable Setback Thermostats

JA5.1 Introduction

This document provides a high level technical specification for an upgradeable setback thermostat (UST). All USTs shall comply with the specifications set forth in this document or specification approved by the Executive Director. This specification focuses on four interfaces that the CEC has determined must be supported by all USTs:

1. HVAC System Interface
2. Communications Interface
3. Expansion Interface
4. Human-Machine Interface

Sections within this document address each interface in terms of its hardware and software characteristics. In general and unless otherwise specified, this specification is compatible with NEMA Standards Publication DC 3-2008 – “Residential Controls – Electrical Wall-Mounted Thermostats”.

The Communications Interface is defined as a set of logical services that may be performed over a physical network interface connected to either the Expansion Interface, or in some cases an internal communications device.

The communications interface is designed to permit a variety of intended uses for USTs that have been defined in other publications. Those uses included remote energy management services to the extent that UST users voluntarily enable such services. To the extent possible, this document strives to be upward compatible with related efforts underway (e.g. NIST, the Smart Grid Interoperability Panel, Open Smart Grid, etc.). Upward compatibility will be facilitated by not specifying any capability or feature that can be foreseen to contradict or impede the clear direction of those related efforts.

UST Vendors should use Title 24 code language, this document, and the documents they reference to make early design decisions on physical design (e.g. mold plastic to support connectors), processing power, code space, working memory, and code licensing. These documents provide enough information to make these decisions. The following elements are addressed in this document and are considered the key requirements that gate early design and decision making:

- Support for the Basic HVAC terminal interface specification
- Support for an expansion port that will allow for the installation of a removable module to enable communications with the thermostat

The following sections describe these and other elements of the specification in more detail.

JA5.1.1 Required Functional Resources

The following UST functional resources are required by Section 122(c) of the Standards:

— An Expansion/Communication port

a)

This port is available to be used by a module supporting one-way or two-way communications supporting standards based communication protocols, including but not limited to Z-wave, Zigbee, WiFi, Radio Data Broadcasting System (RDBS,)/ Radio Data System (RDS), and/or Bluetooth. Refer to Section 3 for more information.

The module shall also enable standards based messaging protocols (Smart Energy Profile (SEP), OpenADR and/or others defined in the Smart Grid Interoperability Panel (SGIP) Catalog of Standards (CoS)).

When the Expansion/Communication port is unpopulated, the thermostat is referred to herein as Non-Upgraded. Section 112(c) refers to this mode as a Programmable Setback Thermostat. When the Expansion/Communication port is populated with a module that provides communications, it is referred to as Upgraded. Section 112(c) refers to this as a Communicating Setback Thermostat.

— b) A display facility which can be located on the standard UST display, using a Liquid Crystal Display, standalone indicator using Light Emitting Diodes, or other means that shall be used to display the following information for the user:

b)

— The current communications status, indicating whether status is normal (e.g. connected, active) or abnormal (e.g. disconnected or inactive) (always displayed).

a.

b. The type of event in progress: Demand Response Period, price event, or no event (always displayed).

c. Thermostat Maintenance-related information: Icons and/or error codes.

d. The currently sensed temperature (always displayed)

e. Current Set Point

c) One or more setting mechanism(s) that allow a customer to change the following thermostat settings at any time:

a. A temperature set point and associated starting time used during normal operation.

i. The UST shall provide a separate pair of parameters for at least four operating periods that collectively govern thermostat operation during the 24-hour day.

b. Temperature offsets that, unless overridden by users or modified by an energy management system or service, may be triggered by price signals or demand response signals:

i. The UST shall provide one offset for price signals and one offset for demand response signals. The offset may be common for both types of events.

1. The UST shall be shipped with a default value of -40F when operating in the heating mode.

2. The UST shall be shipped with a default value of +40F. when operating in the cooling mode.

d) A clock mechanism that allows the UST to execute temperature set points scheduled by the customer.

JA5.1.2 Required Functional Behavior

The following describes how the UST needs to behave and use the functional resources specified above to comply with Load Management Standards requirements.

—Clock Operation

a)

The clock mechanism enables the UST to execute temperature set points scheduled by the customer. It also supports other timing functions such as start- time, end-time and duration for time coordination of Demand Response Periods and price signal response.

Accuracy to a precision of one minute is acceptable for this operating environment and the applications being considered.

The clock in an Upgraded UST may be set or resynchronized by three means: (1) through system communications messages sent by the customer's selected demand response event provider (2) by a customer-authorized energy management system or service, and (3) by the customer, using the UST's human interface. Such action by any source will override a prior setting, regardless of which source set it. In practice they may override each other, an approach that serves the needs of the system and the customer in a balanced way. One possible system update time could be 2 AM, as that is frequently the official time used for changes to and from daylight-savings time.

A DEMAND RESPONSE SIGNAL may also include an update to the UST clock.

The clock in a Non-Upgraded UST may be set by the customer.

—Normal Operation

b)

Normal operation of an Upgraded or a Non-Upgraded UST is defined to be the UST's prevailing mode of operation as determined by the customer's prior settings and use of features² provided by the UST vendor's design or the mode of operation of the energy management system, if any, that a customer has elected to connect to the Upgraded UST. Aspects of normal operation of an Upgraded UST may be modified or interrupted in response to customer subscribed price signals or Demand Response Periods are in progress, but only to the extent specified by customers or their representatives.

² The specific design of such features (e.g. HOLD, OVERRIDE) is defined by individual vendors and not by this document.

Customers shall always have the right to change UST settings or use other features of a UST vendor's design during an event. Those changes may alter what is considered to be the prevailing mode of operation when an Demand Response Period is terminated and the UST returns to normal operation.

Unless a customer has elected to connect the UST to an energy management system or service that provides for alternate strategies, the UST shall, whether Upgraded or Non-Upgraded, provide a mode of operation whereby it controls temperature by following the scheduled temperature set points.

— DEMAND RESPONSIVE CONTROL

c)

Upon receiving a price signal or a Demand Response Signal, Upgraded USTs shall have the ability to adjust the currently applicable temperature set point by the number of degrees indicated in the temperature offset (heating or cooling, as appropriate). Unless a customer shall (i) have elected to connect the Upgraded UST to an energy management system or service that provides for alternate strategies, or (ii) have selected a different default response or no response, Upgraded USTs shall default to price event offsets of +4°F for cooling and -4°F for heating when a price signal triggers a response or a Demand Response Signal is received. Occupants or their representative shall be able to change the current and default offsets and thermostat settings at any time. The UST shall also have the capability to allow occupants to define set points for cooling and heating in response to DEMAND RESPONSE SIGNALS and pricing signals as an alternative to temperature-offsetting response.

Non-Upgraded USTs need not respond to price events.

Override: Upgraded USTs shall allow a customer to alter or eliminate the default response to price signals and/or Demand Response Signals, and to override any individual price response or Demand Responsive Control through use of up/down temperature adjustment buttons, allowing the customer to choose any temperature during the Demand Response Period.

When the price signal changes to a non-response level or the Demand Response Period is concluded, Upgraded USTs shall return to normal operation.

The UST shall also be equipped with the capability to allow customers to define set points for heating and cooling in response to price signals and/or Demand Response Signals as an alternative to temperature-offsetting response as follows:

- The default price response or event set point in the cooling mode for Upgraded USTs shall be 8x oF. The UST shall allow the user to change the default event set point to any other value.
 1.
- The default price response or event set point in the heating mode for Upgraded USTs shall be 6x oF. The UST shall allow the user to change the default event set point to any other value.
 2.
- The UST shall ignore a price event temperature set point lower (in cooling mode) or higher (in heating mode) than the customer selected prevailing set point temperature just before the price event.
 3.

4. Additionally, thermostats shall not be remotely set above 8x °F or below 6x °F. This measure protects customer premises from extreme temperatures that might otherwise be imposed using emergency offsets, should the customer already have a very high or low temperature set point in effect.

Demand response control signals may also include a temperature set point or a set point offset that Upgraded USTs will accept as the set point for the Demand Response Period. The customer may still override or change the set point during these Demand Response Periods.

Summarizing, price signal response and Demand Responsive Control only modify the operating range of the thermostat. They do not otherwise affect the operation and use of features provided by the vendor's design.

JA5.2 The HVAC System Interface

The physical connector on the UST to be presented to the HVAC system shall comply with industry standards as described in NEMA DC 3-2008³ or subsequent revision of this specification.

JA5.3 Expansion Interface

USTs include an expansion port and interface to enable communication capabilities by the addition of a removable module. The removable module may also provide a means of memory storage, logging, and firmware upgrade. The requirements associated with the expansion interface are:

1. The expansion/communication port shall be readily accessible to the occupant for installing and removing the communication module.
2. Installation of the module shall upgrade the programmable setback thermostat to a communicating setback thermostat.
3. After the communication module is installed and the occupant has enrolled in a program or subscribed to a messaging service, the UST shall be capable of both receiving and responding to demand response signals.

The UST's expansion port interface has no mandated specification. Potential physical interfaces include vendor specific or proprietary connections, USNAP, Multi-Media Card (MMC) format, and Universal Serial Bus (USB).

JA5.4 Communications Interface

The communications interface has two aspects – the physical interface and the logical interface.

The physical communications interface includes a one- or two-way communications interface connected through the Expansion Interface as selected and specified by the customer's messaging service or Demand Response service provider. There is no mandated specification for the physical communications. However, Section 110.2(c) specifies that the communications capabilities shall enable DEMAND RESPONSIVE CONTROL through receipt of DEMAND RESPONSE SIGNALS based on communications standards (including but not limited to ZigBee (IEEE 802.15.4) and/or WiFi (IEEE 802.11))

The logical interface consists of the information model used to represent messages sent to the Upgraded UST. Similar to the physical communications interface, no specific standard is mandated, but direction is provided as

³ NEMA DC 3-2008 - <http://www.nema.org/stds/dc3.cfm>

“standards based messaging protocols (Smart Energy Profile (SEP), OpenADR and/or others defined in the Smart Grid Interoperability Panel (SGIP) Catalog of Standards (CoS)⁴”.

JA5.4.1 UST Messages and Attributes

If a DEMAND RESPONSE SIGNAL or price signal is received and validated, but conflicts with a prior message, the newer message shall supersede the previous message and any continuing action for the prior message is automatically terminated by the Upgraded UST (unless the subsequent message attempts to initiate an action that has been disapproved by the consumer).

JA5.4.1.1 Event Modes

The UST specifications recognize the following two basic system event modes:

1. Price signals, with responses that can be overridden by the customer
2. Demand Response Periods, which can also be overridden by the customer.

JA5.4.1.1.1 Price Signals

Price signals allow the utility or another entity selected by the customer to send a signal or message providing pricing information to the customer to initiate Demand Responsive Control for the Demand Response Period utilizing a Demand Response Signal.

Price Signal attributes and requirements shall be specified within the messaging protocol utilized by the utility or other entity selected by the customer.

JA5.4.1.1.2 Demand Response Periods

This event class allows the utility or another entity selected by the customer to initiate Demand Responsive Control for the Demand Response Period utilizing a Demand Response Signal.

Demand Response Signal attributes and requirements shall be specified within the messaging protocol utilized by the utility or other entity selected by the customer.

JA5.4.2 Security

The UST communications system must be secure from a variety of cyber-attacks. A thorough discussion of security issues may be found at: <http://collaborate.nist.gov/twiki-sggrid/bin/view/SmartGrid/CyberSecurityCTG>.

Demand Response Signal security attributes and requirements shall be specified within both the communications standard and the messaging protocol utilized by the utility or other entity selected by the customer.

JA5.4.2.1 Business Logic

1. Thermostats shall have hard-coded limits on what set points will be accepted via remote commands, to prevent unsafe set points.
2. Unless the messaging protocol contains randomization or restoration delay logic, Upgraded USTs shall randomly delay for up to 30 minutes after being instructed to conclude or cancel a Demand Response

⁴ <http://collaborate.nist.gov/twiki-sggrid/bin/view/SmartGrid/SGIPCoSStandardsInformationLibrary>

Period, thereby avoiding sudden increases in load on the grid. The display of the thermostat shall not indicate the end of the event until after the random delay.

3. Time synchronization commands received via the customer's selected demand response provider shall update and override any previous set time.

JA5.5 Human-Machine Interface

This section discusses the interface between humans and the UST. All core functional requirements for the Human-Machine Interface are defined in Load Management Standards. The following section addresses requirements for terminology.

JA5.5.1 Terminology

The only human-machine interface standardization required to support the Load Management Standards requirements is a clear definition of terminology. All other standard features of the UST are up to the discretion and innovative talents of the thermostat manufacturers.

UST user interface and documentation shall use the following terminology.

<u>Demand Response</u>	<u>Short-term changes in electric usage by end-use customers, from their normal consumption patterns. Demand response may be in response to:</u> a. <u>changes in the price of electricity; or</u> b. <u>participation in programs or services designed to modify electricity use</u> i. <u>in response to wholesale market prices or</u> ii. <u>when system reliability is jeopardized.</u>
<u>Demand Response Period</u>	<u>Period of time during which electricity loads are modified in response to a demand response signal.</u>
<u>Demand Response Signal</u>	<u>Signal sent by the local utility, Independent System Operator (ISO), or designated curtailment service provider or aggregator, to a customer, indicating a price or a request to modify electricity consumption, for a limited time period.</u>
<u>Demand Responsive Control</u>	<u>Kind of control that is capable of receiving and automatically responding to a demand response signal.</u>
<u>Energy Management Control System (EMCS)</u>	<u>A computerized control system designed to regulate the energy consumption of a building by controlling the operation of energy consuming systems, such as the heating, ventilation and air conditioning (HVAC), lighting, and water heating systems. The EMCS must also be capable of monitoring environmental and system loads, and adjusting HVAC operations in order to optimize energy usage and respond to demand response signals.</u>
<u>Price Event</u>	<u>Refers to a change in pricing sent to the UST from the utility or the customer's selected demand response provider.</u>
<u>Critical Peak Pricing Event (CPP)</u>	<u>A type of price event. When a CPP is received by the UST, the device should take appropriate behavior as defined by the settings configured by the customer.</u>
<u>Override</u>	<u>Refers to a person adjusting the functional behavior of the UST to ignore a demand response or price message.</u>

<u>Provision</u>	<u>Describes the commissioning or binding process of connecting a UST to an in-premise network or the communications network of the customer's selected demand response provider.</u> <u>NOTE: This process depends critically on the data security solution chosen.</u>
<u>Pending Event</u>	<u>Refers to a price event or Demand Response Period that is scheduled but has not yet happened.</u>
<u>Active Event</u>	<u>Refers to a price event or Demand Response Period that is underway.</u>

JA5.6 Restoring Temperature Offsets and Set points

The UST shall include the capability to allow the occupant to restore the default temperature offsets and set points to the defaults specified in 112(c)2.a.i and Reference Joint Appendix JA5 (factory installed set points). Removing and re-inserting the removable communication module shall also restore all temperature offsets and set points to factory installed default set points.

JA5.7 Onboard Communications Devices

Exception 3 to Section 110.2(c) allows onboard communication devices under certain conditions. When onboard communication devices are present, the thermostat or HVAC control system shall:

- a) Meet all other technical requirements specified in Sections 5.1 through 5.6 of this document,
- b) Be equipped with the capability to turn on or turn off power to the onboard communication device, rendering it inoperative.

Joint Appendix JA6

Appendix JA4 ~~Appendix JA6~~ – Charge Indicator Display ~~HVAC Fault Detection and Diagnostic Technology~~

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~~JA4.1~~ JA6.1 ~~Purpose and Scope~~ Charge Indicator Display (CID)

JA6.1.1 Purpose and Scope

Joint Appendix JA6.1 defines required elements for charge indicator display technologies that utilize instrumentation and computer software functionality to monitor and determine the operating performance of vapor compression air conditioning and heat pump systems, to provide visual indication to the system owner/operator if the system's refrigerant charge or metering device performance does not conform to approved target parameters for minimally efficient operation.

~~JA6.1.6~~ ~~JA6.1.2~~ specifies the required instrumentation, instrumentation accuracy, parameters measured, required calculations, allowable deviations from target values for system operating parameters, and the requirements for system fault indication for a charge indicator display technology that conforms to the methods for verifying refrigerant charge and metering device performance described in Reference Residential Appendix RA3.2.

Charge indicator display technologies other than ~~that what is~~ described in ~~Section JA6.1~~ ~~JA6.2~~ are possible, and when vapor compression air conditioner and heat pump system refrigerant charge, metering device and airflow operating performance can be reliably determined by methods and instrumentation other than those specifically defined in section ~~JA6.2~~ ~~JA6.1~~ such alternative charge indicator display technologies shall be allowed for Charge Indicator Display compliance credit if the manufacturer of the product requests approval from the Executive Director. The Executive Director will grant such approval after reviewing submittals from the

applicant. Charge indicator display technologies that are approved by the Executive Director will be published as an addendum to this appendix.

The applicant shall provide information that specifies the required instrumentation, the instrumentation accuracy, the parameters measured, the required calculations, the allowable deviations from target values for system operating parameters, and the requirements for system fault indication.

JA6.1.2 CID Product Approval

Charge indicator display technology manufacturers shall certify to the Energy Commission that the charge indicator display technology meets the requirements of Reference Joint Appendix JA6.1.

JA6.1.3 CID Installation

Charge indicator display devices shall be factory installed by the space-conditioning system manufacturer, or field installed according to the space-conditioning system manufacturer's requirements and the CID manufacturer's specifications.

JA6.1.4 CID Product Documentation

Manufacturers of charge indicator display CID technologies shall, upon request, provide comprehensive engineering specification documentation, installation and technical field service documentation, and homeowner user instructions documentation to designers, installers, service personnel and homeowners who utilize the technology.

JA6.1.5 Optional Fault Detection Capabilities

The charge indicator display CID may also be used to signal other system operation faults as long as these additional functions do not detract from the proper function of the refrigerant charge, metering device, or airflow operation indications.

~~JA4.2.0~~ JA6.1.6 Standard Requirements for a Charge Indicator Display

This section specifies the required instrumentation, the instrumentation accuracy, the parameters measured, the required calculations, the allowable deviations from target values for system operating parameters, and the requirements for system fault indication for a charge indicator display technology.

~~JA4.2.1.0~~ JA6.1.6.1 Instrumentation Specifications

Instrumentation for the procedures described in ~~JA6.2~~ JA6.1.6 shall conform to the following specifications:

~~JA4.2.1.1.0~~ JA6.1.6.1.1 Temperature Sensors

The temperature sensors shall have an accuracy of plus or minus 1.8°F ~~1.5°F~~.

~~JA4.2.1.2.0~~ JA6.1.6.1.2 Refrigerant Pressure Sensors (if used)

Refrigerant pressure sensors, ~~if used~~, shall have an accuracy of plus or minus 3 percent of full scale.

~~JA4.2.1.3.0~~ JA6.1.6.1.3 Parameters Measured

The following parameters shall be measured:

1. Suction line temperature (T_{suction})
2. Liquid line temperature (T_{liquid})
3. Evaporator saturation temperature or low side refrigerant pressure ($T_{\text{evaporator, sat}}$)
4. Condenser saturation temperature or high side refrigerant pressure ($T_{\text{evaporator, sat}}$ $T_{\text{condensor, sat}}$)

5. Return air wet bulb temperature or humidity ($T_{\text{return, wb}}$)
6. Return air dry bulb temperature ($T_{\text{return, db}}$)
7. Condenser air entering dry bulb temperature ($T_{\text{condenser, db}}$)
8. Supply air dry bulb temperature ($T_{\text{supply, db}}$)

JA4.2.2.0 JA6.1.6.2 Refrigerant Charge, Metering Device, and Airflow Calculations

Refrigerant charge, metering device and airflow calculations for determining superheat, subcooling, and temperature split values shall conform to the specifications of this section utilizing the measured parameters data from instrumentation as specified in Section ~~JA6.2.4~~ JA6.1.6.1.

JA4.2.2.1.0 JA6.1.6.2.1 Fixed Metering Device Calculations

The fixed metering device calculations are used only for systems equipped with fixed metering devices. These include capillary tubes and piston-type metering devices.

1. Calculate Actual Superheat as the suction line temperature minus the evaporator saturation temperature.
Actual Superheat = $T_{\text{suction}} - T_{\text{evaporator, sat}}$
2. Determine the Target Superheat using Reference Residential Appendix RA3 Table RA3.2-2, the return air wet-bulb temperature ($T_{\text{return, wb}}$) and the condenser air entering dry-bulb temperature ($T_{\text{condenser, db}}$). If a dash mark is read from Reference Residential Appendix RA3 Table RA3.2-2, the target superheat is less than 5°F.
3. Calculate the difference between Actual Superheat and Target Superheat (Actual Superheat - Target Superheat)

JA4.2.2.2.0 JA6.1.6.2.2 Variable Metering Device Calculations

The variable metering device calculations are used only for systems equipped with variable metering devices. These include Thermostatic Expansion Valves (TXV) and Electronic Expansion Valves (EXV).

1. Calculate Actual Subcooling as the condenser saturation temperature minus the liquid line temperature.
Actual Subcooling = $T_{\text{condenser, sat}} - T_{\text{liquid}}$
2. Determine the Target Subcooling specified by the manufacturer.
3. Calculate the difference between actual subcooling and target subcooling (Actual Subcooling - Target Subcooling).
4. Calculate Actual Superheat as the suction line temperature minus the evaporator saturation temperature.
Actual Superheat = $T_{\text{suction}} - T_{\text{evaporator, sat}}$
5. If possible, determine the Superheat Range specified by the manufacturer.

JA4.2.2.3.0 JA6.1.6.2.3 Minimum Airflow Calculations

The minimum airflow calculations are designed to determine whether the rate of airflow across the evaporator coil is above the minimum airflow rate requirement for a valid refrigerant charge test result.

1. Calculate the Actual Temperature Split as the return air dry-bulb temperature minus the supply air dry-bulb temperature. Actual Temperature Split = $T_{\text{return, db}} - T_{\text{supply, db}}$
2. Determine the Target Temperature Split from ~~Reference Residential Appendix Table RA3.2-3~~ Table JA6.1-1 using the return air wet-bulb temperature ($T_{\text{return, wb}}$) and return air dry-bulb temperature ($T_{\text{return, db}}$).
3. Calculate the difference between target and actual temperature split (Actual Temperature Split - Target Temperature Split).

JA4.2.3.0 JA6.1.6.3 System Fault Indication

Data from instrumentation specified in [Section JA6.2.1 JA6.1.6.1](#) and calculations specified in [Section JA6.2.2 JA6.1.6.2](#) shall be processed and interpreted continuously or at sufficiently frequent time step intervals, during normal system operation, to insure that system operating conditions that meet the system fault criteria of this section will be detected, and indicated by the charge indicator display. Data from instrumentation specified in [Section JA6.2.1 JA6.1.6.1](#) and calculations specified in [Section JA6.2.2 JA6.1.6.2](#) shall be processed and interpreted in a manner that prevents indication of system faults when system fault criteria are triggered by temporary or transitory operating conditions that are not true indicators of problems with refrigerant charge, metering device, or airflow performance.

The charge indicator display shall:

1. be clearly visible to occupants of the home during normal operation.
2. be located on or within one foot of (one of) the thermostat(s) controlling the air conditioner.
3. display an indication of a system fault requiring service or repair when system normal operation fails to meet the required operating performance criteria specified in this section. These system fault indications shall be displayed for a period of at least 7 days after a system fault is detected unless the charge indicator display is reset by the installing or servicing technician.

- a. Refrigerant charge verification criterion for fixed metering device systems.

If the air conditioner has a fixed metering device, runs for 15 minutes, has a Target Superheat value determined by Reference Residential Appendix RA3 Table RA3.2-2 that is greater than or equal to 5°F, the condenser air entering temperature is greater than or equal to 65°F, and the minimum airflow requirement from item d below is satisfied, then the conditions for a valid refrigerant charge test are satisfied.

If the conditions for a valid refrigerant charge test are satisfied, and the air conditioner has an Actual Superheat value that deviates more than plus or minus 10°F from the Target Superheat value determined by Reference Residential Appendix RA3 Table RA3.2-2, then the system fails the refrigerant charge test, and a system fault shall be reported.

- b. Refrigerant charge verification criterion for variable metering device systems.

If the air conditioner has a TXV or EXV, runs for 15 minutes, the condenser air entering temperature is greater than or equal to 65°F, and the minimum airflow requirement from item d below is satisfied, then the conditions for a valid refrigerant charge test are satisfied.

If the conditions for a valid refrigerant charge test are satisfied, and the air conditioner has an Actual Subcooling value that deviates more than plus or minus 6°F from the Target Subcooling value listed by the manufacturer, then the system fails the refrigerant charge test, and a system fault shall be reported.

- c. Variable metering device function verification criterion.

If the air conditioner has a TXV or EXV, runs for 15 minutes, the condenser air entering temperature is greater than or equal to 65°F, and the minimum airflow requirement from item d below is satisfied, then the conditions for a valid metering device test are satisfied.

If the conditions for a valid metering device test are satisfied, and the air conditioner has an Actual Superheat value outside the range specified by the manufacturer (or outside the range 2°F to 28°F if there is no manufacturer's specification), then the system fails the metering device test, and a system fault shall be reported.

- d. Minimum airflow verification criterion.

If the air conditioner runs for 15 minutes, and the condenser air entering temperature is greater than or equal to 65°F, then the conditions for a valid minimum airflow test are satisfied.

If the conditions for a valid minimum airflow test are satisfied, and the air conditioner has an Actual Temperature Split value that deviates more than plus 5°F from the Target Temperature Split value

determined by Reference Residential Appendix RA3 Table RA3.2-3, then the system fails the minimum airflow test, and a system fault shall be reported.

~~JA4.2.4.0~~ **JA6.1.6.4 Additional System Fault Indication** *Optional Functionality*

The charge indicator display devices may be set to tighter specifications than those specified in Section JA6.2.3 JA6.1.6.3. The charge indicator display may also be used to signal other system faults as long as these additional diagnostic functions do not detract from the accuracy of the measurement and reporting of system faults as ~~indications~~ specified in ~~JA6.2.3~~ Section JA6.1.6.3.

JA6.1.6.4.1 Self Diagnostic Reporting

When equipped with self diagnostic reporting functionality, the CID shall check for communication with every sensor and provide an indication when there are any sensor failures.

JA6.1.6.4.2 Data Access

In order to provide for verification of sensor data and CID system functionality, data access shall be provided. The CID manufacturer shall specify the data access method(s), and the minimum data reporting capability including requirements for any data history reporting.

Table JA6.1-1 Target Temperature Split (Return Dry-Bulb – Supply Dry-Bulb)

Return Air Wet-Bulb (°F) (T return, wb)

	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76		
70	20.9	20.7	20.6	20.4	20.1	19.9	19.5	19.1	18.7	18.2	17.7	17.2	16.5	15.9	15.2	14.4	13.7	12.8											
71	21.4	21.3	21.1	20.9	20.7	20.4	20.1	19.7	19.3	18.8	18.3	17.7	17.1	16.4	15.7	15.0	14.2	13.4	12.5										
72	21.9	21.8	21.7	21.5	21.2	20.9	20.6	20.2	19.8	19.3	18.8	18.2	17.6	17.0	16.3	15.5	14.7	13.9	13.0	12.1									
73	22.5	22.4	22.2	22.0	21.8	21.5	21.2	20.8	20.3	19.9	19.4	18.8	18.2	17.5	16.8	16.1	15.3	14.4	13.6	12.6	11.7								
74	23.0	22.9	22.8	22.6	22.3	22.0	21.7	21.3	20.9	20.4	19.9	19.3	18.7	18.1	17.4	16.6	15.8	15.0	14.1	13.2	12.2	11.2							
75	23.6	23.5	23.3	23.1	22.9	22.6	22.2	21.9	21.4	21.0	20.4	19.9	19.3	18.6	17.9	17.2	16.4	15.5	14.7	13.7	12.7	11.7	10.7						
76	24.1	24.0	23.9	23.7	23.4	23.1	22.8	22.4	22.0	21.5	21.0	20.4	19.8	19.2	18.5	17.7	16.9	16.1	15.2	14.3	13.3	12.3	11.2	10.1					
77	-	24.6	24.4	24.2	24.0	23.7	23.3	22.9	22.5	22.0	21.5	21.0	20.4	19.7	19.0	18.3	17.5	16.6	15.7	14.8	13.8	12.8	11.7	10.6	9.5				
78	-	-	-	24.7	24.5	24.2	23.9	23.5	23.1	22.6	22.1	21.5	20.9	20.2	19.5	18.8	18.0	17.2	16.3	15.4	14.4	13.4	12.3	11.2	10.0	8.8			
79	-	-	-	-	-	24.8	24.4	24.0	23.6	23.1	22.6	22.1	21.4	20.8	20.1	19.3	18.5	17.7	16.8	15.9	14.9	13.9	12.8	11.7	10.6	9.4	8.1		
80	-	-	-	-	-	-	25.0	24.6	24.2	23.7	23.2	22.6	22.0	21.3	20.6	19.9	19.1	18.3	17.4	16.4	15.5	14.4	13.4	12.3	11.1	9.9	8.7		
81	-	-	-	-	-	-	-	25.1	24.7	24.2	23.7	23.1	22.5	21.9	21.2	20.4	19.6	18.8	17.9	17.0	16.0	15.0	13.9	12.8	11.7	10.4	9.2		
82	-	-	-	-	-	-	-	-	25.2	24.8	24.2	23.7	23.1	22.4	21.7	21.0	20.2	19.3	18.5	17.5	16.6	15.5	14.5	13.4	12.2	11.0	9.7		
83	-	-	-	-	-	-	-	-	-	25.3	24.8	24.2	23.6	23.0	22.3	21.5	20.7	19.9	19.0	18.1	17.1	16.1	15.0	13.9	12.7	11.5	10.0		
84	-	-	-	-	-	-	-	-	-	25.9	25.3	24.8	24.2	23.5	22.8	22.1	21.3	20.4	19.5	18.6	17.6	16.6	15.6	14.4	13.3	12.1	10.0		

JA6.2 Saturation Pressure Measurement Sensors

JA6.2.1 Purpose and Scope

Appendix JA6.2 specifies the required instrumentation, and the instrumentation accuracy, for a saturation pressure measurement (SPMS) device intended to provide a means for a HERS Rater to observe space conditioning system refrigerant pressure measurement data without attaching refrigerant gages to the refrigerant system service access ports.

The SPMS device manufacturer shall provide certification to the commission that the SPMS device will and approved for use by the Commission

JA6.2.2 SPMS Device Approval

SPMS devices, if approved by the Executive Director, shall be allowed for use for determining compliance with the refrigerant charge verification requirements in the Standards. The Executive Director will grant such approval after reviewing submittals from the applicant. SPMS devices that are approved by the Executive Director will be listed as approved SPMS devices in directories published by Energy Commission.

Manufacturers of approved SPMS devices shall, upon request, provide comprehensive engineering specification documentation, installation and technical field service documentation, and user instructions documentation to installers and service personnel that utilize the procedure.

JA6.2.3 Standard for Saturation Pressure Measurement Sensors

SPMS devices shall measure and report the refrigerant system pressure for both the high pressure side and the low pressure side of the refrigerant system within the tolerances given in Section JA6.1.2.2.1.

JA6.2.3.1 Instrumentation Specifications

The pressure measurement instrumentation shall have an accuracy of ± 3 percent of discharge pressure and ± 1.0 psig suction pressure.

JA6.2.3.2 Installation

SPMS devices shall be installed by the space-conditioning equipment manufacturer, or installed in the field according to any applicable space-conditioning equipment manufacturer requirements, within 12 inches of the refrigerant system service port.

Joint Appendix JA7

Appendix JA7 – Data Registry Requirements

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JA7.1 Purpose and Scope

Joint Appendix JA7 specifies required functional and technical elements for Data Registries that provide services to authorized users and receive data to produce, register, retain, and distribute copies of compliance documents required for compliance with Title 24 Part 6. The functional and technical elements specified in this document include the following:

- Document registration is defined.
- Roles and responsibilities for users and administrators of data registries are defined.
- Requirements for registered documents are defined.
- Requirements for configuration of project documents in the Data Registry are defined.
- Requirements for electronic and digital signatures used on registered documents are defined.
- Requirements for data exchange between Data Registries and external software tools are defined.
- Requirements for transmittal of copies of documents to a document repository at time of registration are defined.
- Procedures for approval of Data Registries and software used for data input to data registries are defined.

A Data Registry Requirements Manual is expected to be approved by the Energy Commission to provide additional detailed guidance regarding functional and technical aspects of the requirements in Reference Joint Appendix JA7.

JA7.2 Definitions

For the purposes of the specifications in Reference Joint Appendix JA7, the following definitions shall apply:

Asymmetric Key Encryption is also known as public key encryption. This type of encryption uses a pair of keys that are mathematically related: one key for encryption and another key for decryption. In digital signature processing, a user is assigned a private key that is not shared with anyone, and a public key that is given to anyone who receives digitally signed material from the user.

From California Code of Regulations, Title 2. Administration, Division 7. Secretary Of State Chapter 10. Digital Signatures, 22003, List of Acceptable Technologies: "The technology known as Public Key Cryptography is an acceptable technology for use by public entities in California..."

All major development environments such as Microsoft and Adobe support PKCS1 asymmetrical key encryption.

Authorized User is a person who has a user account with a Data Registry and is required to provide their correct user name and password in order to access the Data Registry. Data Registry users may be required to provide professional licensure, certification or credential information, or other qualifying information as condition of receiving authority to provide signatures for certain types of documentation.

Commission means the State of California Energy Resources Conservation and Development Commission, commonly known as the California Energy Commission, also referred to as the Energy Commission.

Commission Compliance Document Repository is an electronic database and document storage software application used for retention of Registered electronic Compliance Documents generated by Data Registries, and may also contain data and documentation relevant to other regulatory procedures administered by the California Energy Commission. The Commission Compliance Document Repository shall maintain these retained documents in accordance with Evidence Code section 1530-1532 (in the custody of a public entity).

Compliance Data Exchange File is an XML file that contains compliance data used to populate a Compliance Document. The Compliance Data Exchange File is part of the Compliance Registration Package.

Compliance Document is one of the following documents required for demonstration of compliance with Title 24, Part 6: Certificate of Compliance, Certificate of Installation, Certificate of Acceptance, Certificate of Verification.

Compliance Registration Package means encrypted digital data that is transmitted to a Data Registry that contains the data required for registering a Compliance Document with a Data Registry, including the Compliance Data Exchange File. The most commonly used method is the Zip file format, a data compression and archiving specification that is in the public domain. Files transmitted to a Data Registry using the Zip file format shall be password protected as described in JA7.6.3.2.7.

Compliance Report Generator is a webservice maintained by the Commission that receives standardized document data exchange files from third party software approved by the Commission and produces the document registration package required to complete registered compliance documents in data registries that are approved by the Commission.

Compliance Software is software approved by the California Energy Commission for use in demonstrating compliance with the performance standards in Title 24 Part 6.

Cryptographic Hash Function is a mathematical function that creates a unique number that represents the contents of a block of data or text. In digital signature processing the data or text that the user is digitally signing is called the message. The number generated by the cryptographic hash function is called the message digest. To verify a copy of the message, the cryptographic hash function is applied to both the original message and the copy of the message, and the resulting message digests are compared. If they are both the same, then the copy is valid.

There are a number of cryptographic hash functions used in digital signature processing. All major development environments such as Microsoft and Adobe support the most commonly used hash algorithm

family, SHA-1, SHA-256, SHA-384, SHA-512 hash algorithms which were developed by National Security Agency (NSA).

Data Registry is a web service with a user interface and database maintained by a Registration Provider that complies with the applicable requirements in Reference Joint Appendix JA7, with guidance from the Data Registry Requirements Manual, and provides for registration of residential or nonresidential compliance documentation used for demonstrating compliance with Part 6..

Residential Data Registry is a data registry that is maintained by a HERS Provider, that provides for registration, when required by Part 6, of all residential compliance documentation and the nonresidential Certificate of Verification.

Nonresidential Data Registry is a data registry that is maintained by a HERS Provider or a Registration Provider approved by the Commission, that provides for registration, when required by Part 6, of all nonresidential compliance documentation. However, nonresidential data registries may not provide for registration of nonresidential Certificates of Verification.

Data Registry Requirements Manual is a document that provides additional detailed guidance regarding the functional and technical aspects of the data registry requirements given in Joint Appendix JA7.

Digital Certificate is a computer-based record that contains a person's identifying information and the person's digital signature public key, as well as information about the certificate authority that issued the Digital Certificate and the certificate authority's digital signature verifying the authenticity of the person's identity and digital signature. Although the Secretary of State Digital Signature regulations, Section 22003 (a) 2C states "although not all digitally signed communications will require the signer to obtain a certificate, the signer is capable of being issued a certificate to certify that he or she controls the key pair used to create the signature, "

Digital Signature an electronic signature that incorporates cryptographic methods of originator authentication, allowing the identity of the signer and the integrity of the data to be verified. The regulations adopted by the Secretary of State that govern the use of Digital Signatures for use by public entities in California are found in the California Code of Regulations, Title 2, Division 7, Chapter 10 Digital Signatures.

DOCUMENTATION AUTHOR is a person who prepares a Title 24 Part 6 compliance document that must subsequently be reviewed and signed by a responsible person in order to certify compliance with Part 6.

Electronic Signature is a "computer data compilation of any symbol or series of symbols executed, adopted, or authorized by an individual to be the legally binding equivalent of the individual's handwritten signature." US 21 Code of Federal Regulations (CFR) Section 11.3.

For the purposes of using electronic signatures to sign compliance documents, the electronic signature shall be an electronic image of the signer's handwritten signature.

Executive Director means the Executive Director of the Energy Commission.

Field Technician is a person who performs acceptance tests in accordance with the specifications in Reference Joint Appendix NA7, and reports the results of the acceptance tests on the Certificate of Acceptance in accordance with the requirements of Section 10-103(a)4.

HERS is the California Home Energy Rating System as described in TITLE 20, Chapter 4, Article 8, Section 1670.

HERS Provider is an organization that administers a home energy rating system as described in TITLE 20, Chapter 4, Article 8, Section 1670.

HERS Rater is a person who has been trained, tested, and certified by a HERS Provider to perform the field verification and diagnostic testing required for demonstrating compliance with the Part 6, as described in TITLE 20, Chapter 4, Article 8, Section 1670(i)

HERS Provider Data Registry is a data registry maintained by a HERS provider.

Login (see Secure Login)

Message is a block of data or text that has been digitally signed.

Message Digest is the unique number generated when a Cryptographic Hash Function is applied to the Message which is the data or text that is digitally signed.

Password is a string of characters used for authenticating a user on a computer system.

Private Key is one of the keys in Asymmetric Key Encryption used in a Digital Signature. As its name implies, the Private Key should only be known to the owner of the Digital Signature. The private key is used to encrypt the Message Digest of the message that the user digitally signed.

Public Key is one of the keys in Asymmetric Key Encryption used in a Digital Signature. As its name implies, the Public Key must be made public to receivers of digitally signed documents in order to decrypt the Message Digest.

Registered Document is a compliance document that has been submitted to a residential or nonresidential data registry for retention, verified as complete, and has gone through the registration process so that the Registered Document displays all applicable electronic signatures as well as the registration provider's digital certificate and the document's unique registration number. The image of the registered document is accessible for printing or viewing by authorized users of the data registry via the registration provider's internet website. The registered document's unique visible registration number is appended onto the document image by the data registry.:

A Registered Document meets all applicable requirements in Standards Section 10-103(a), Reference Joint Appendix JA7, and may conform to the guidance given in the Data Registry Requirements Manual.

Registration is the process applicable to electronic Compliance Documents that are verified as complete by the Data Registry, and are electronically signed by all required Data Registry Authorized Users. Registration is initiated when an authorized Registration Signer signs the Compliance Document electronically where subsequently the data registry adds the Registration Signer's Electronic Signature to the signature block, appends a unique Registration Number to each page of the document, and then applies the Registration Provider's Digital certificate issued by a Certificate Authority approved by the California Secretary of State to the Compliance Document and displays the Registration Provider's digital signature in the signature block. When Registration is complete, the Data Registry immediately and automatically transmits a copy of the completed Registered Compliance Document to the Commission Compliance Document Repository and also retains a copy of the Registered Compliance Document for use by authorized users for submittals.

Registration Number is an alphanumeric sequence of digits and delimiters appended to a Compliance Document when the document's Registration Signer provides his or her Electronic Signature to the Data Registry to complete Registration for any document. Each Registration Number shall be unique to only one document. The registration numbering convention utilizes specific digits to reference the document type, revision level, and the parent-child relationships between the compliance documents in a specific project.

Registration Provider is an organization that administers a data registry service that conforms to the requirements in Reference Joint Appendix JA7 and may conform to the guidance given in the Data Registry Requirements Manual.

Registration Signer is a Responsible Person as defined in Title 24, part 1, Section 10-102, or as specified by other applicable qualifying regulations, who has established a user account with a Data Registry and has provided sufficient evidence to the Registration Provider to qualify for the authorization to register applicable compliance documentation by providing an electronic signature. The Documentation Author and Registration Signer on a compliance document may be one and the same person or they may be different persons.

Secure Login means the unique Username and Password given to an Authorized User for maintaining the security of the Data Registry. Authorized Users may not share their Secure Login with any other individual for any purpose. Violation of this policy may constitute fraud, and can be cited as a reason for denial of access for all the persons involved, including the user who releases their Secure Login to another person or persons, and the person or persons who use the Secure Login to gain access the Data Registry.

Standards means the California Building Energy Efficiency Standards, Title 24, Part 6.

Standards Data Dictionary (SDD) is a dictionary that contains all data and technical terms used to describe building components, equipment, attributes and measurements that are regulated by the Standards. The

purpose of the SDD is to provide the vocabulary that is used in expressing standards as well as published compliance documentation.

URI stands for Uniform Resource Indicator which is a standard for identifying a name or a resource on the Internet.

URL stands for Uniform Resource Locator is a type of URI used to identify locations on the World Wide Web

Username is a name that uniquely identifies someone on a computer system. The Username is paired with a Password to create a Secure Login.

W3C stands for World Wide Web Consortium which is an international standards body that develops standards for the World Wide Web.

XML stands for Extensible Markup Language and is a set of rules for encoding documents in machine-readable form to facilitate the electronic transmission of documents. XML standard was developed by the W3C

XML Schema refers to XML Schema Definition Language, commonly referred to as XSD, which is another standard defined by the W3C. An XML schema uses XSD to define a set of rules to which an XML document must conform in order to be considered valid according to that schema. The rules can include definition of major organizational units, definition of data elements and attributes data types, constraints on valid values such as upper and lower bounds, and whether data is required or optional.

XSL-FO stands for Extensible Stylesheet Language Formatting Objects and is a standard of the W3C for representing content from an XML document. It is based on a standard vocabulary of document plus formatting and layout directives that can be interpreted by a computer application called an FO processor. XSL-FO is commonly used as a intermediary to generate PDF and printable documents.

XSLT stands for Extensible Stylesheet Language Transformation which is a standard from the W3C for translating an XML document into another format such as XSL-FO or HTML

JA7.3 Introduction

A Data Registry is a web service with a user interface and database maintained by a registration provider that provides for registration of residential or nonresidential compliance documentation used for demonstrating compliance with Part 6. Data Registries shall conform to the requirements specified in Reference Joint Appendix JA7 and may conform to the guidance given in the Data Registry Requirements Manual.

A Data Registry shall include the minimum functional features specified by Reference Joint Appendix JA7. Additional guidance on functional features may be given in the Data Registry Requirements Manual.

Document registration is the process for verifying, serializing, and signing electronic compliance documents produced using a method approved by the Commission. Approved Data Registries are the entities that implement and manage the procedures for registering documents. The procedures include authenticating and approving users to submit or sign electronic documents and data for registration, validating that these data and documents are completed in conformance with the requirements defined by the Standard Section 10-103(a) and Reference Joint Appendix JA7, and affixing the electronic signature of the Documentation Author. The registration process is completed only when an authorized registration signer signs the compliance document electronically; whereupon the Data Registry automatically performs the following actions:

- Adds the registration signer's electronic signature to the document's signature block.
- Appends a unique registration number to each page of the document.
- Applies the registration provider's digital certificate containing their digital signature to the entire compliance document.
- Displays the registration provider's digital signature in the signature block that includes a date and time stamp corresponding to the date and time of the document registration process conclusion.
- When the document registration process has concluded, the Data Registry shall immediately and automatically transmit a copy of the completed registered compliance document to the Commission Compliance Document Repository.
- The Data Registry shall also retain a copy of the registered compliance document for use by authorized users for submittals.

Paper copies of registered compliance documents printed directly from the Data Registry website, or electronic copies downloaded from the Data Registry website shall be used for submittal to enforcement agencies or other parties to the building construction project.

The registration provider's digital signature provides for automatic electronic verification of the authenticity of electronic copies of registered documents.

The electronic copies of the registered documents retained by the Commission Compliance Document Repository shall be utilized to satisfy public information requests, perform research, and shall be maintained in a manner conforming to Evidence Code section 1530-1532 (in the custody of a public entity) for use in enforcement of the Standards.

Any person or entity wishing to have a Data Registry approved shall submit an application to the Energy Commission. Data Registries may be approved by the Energy Commission or by the Executive Director to provide document Registration services. Data Registries shall conform to the requirements of Reference Joint Appendix JA7. Detailed guidance for implementation of the requirements in Appendix JA7 may be given in the Registry Requirements Reference Manual.

JA7.4 Roles and Responsibilities - Authorized Users

This section summarizes the roles and responsibilities for the individuals who participate in the document registration procedures administered by a Data Registry. However, this section is not a complete accounting of the responsibilities of the respective parties.

JA7.4.1 Registration Provider

A Registration Provider is an entity that has been approved by the Energy Commission to provide Data Registry services. Registration Providers maintain Data Registries that conform to the requirements in Reference Joint Appendix JA7 and utilize the guidance in the Data Registry Requirements Manual. Registration Providers are required to retain completed registered compliance documents and make copies of the registered documents available to authorized users for submittals to enforcement agencies or to other parties to the building project that require the documents. Registration Providers make services available that enable authorized users of their Data Registry to verify the authenticity of paper and electronic copies of the retained registered documents.

In order to facilitate Commission oversight of a registration provider's documentation processes, the registration providers shall grant authorization to Energy Commission staff to view the data and documents retained in the data registry, and shall provide functionality that allows Energy Commission staff to query retained data or documents.

For residential compliance document registration, the Registration Provider is required to be a HERS Provider approved by the Energy Commission. For nonresidential compliance document registration, the Registration Provider is required to be either a HERS Provider approved by the Energy Commission, or a Registration Provider approved by the Commission.

JA7.4.2 Authorized Users

Authorized users are persons who have established a user account with a Data Registry and are required to provide their correct user name and password in order to access the secured information in that Data Registry. Data Registry authorized users may be required to provide proof of professional licensure, professional certification, or other qualifying information as a condition for receiving authority to access records or provide signatures for certain types of documentation. User accounts shall be established for each Data Registry for which a user must gain access.

The information required to establish a user account with a Data Registry shall be determined by the Registration Provider who shall gather and verify any and all information necessary to validate a user applicant's identity or applicable professional qualifications as prerequisite to authorizing assignment to a user applicant an electronic signature, or permissions as a documentation author, or permissions as a registration signer.

Additional guidance for establishing user accounts may be given in the Data Registry Requirements Manual.

The roles and responsibilities in the remainder of this section JA7.4 describe specific types of authorized users of the Data Registry. Additional guidance describing roles and responsibilities of Registration Providers and authorized users may be described in the Data Registry Requirements Manual.

JA7.4.3 View-Only Authorized User

Data Registries may provide user accounts that allow users to view only certain records. These types of accounts may allow access to records to view, print or download copies of compliance documents in order to validate the information submitted to enforcement agencies on paper copies of registered documents, and for determining the status of completion of the full documentation package for a project.

JA7.4.4 Documentation Author

Documentation Authors are persons who prepare Title 24 Part 6 compliance documents that must subsequently be reviewed and signed by a Registration Signer (responsible person) in order to certify compliance with Part 6.

Documentation Authors assist with input of information required to complete the compliance documents required for the registration procedures in a Data Registry. Documentation authors who provide support for preparation of compliance documents in a Data Registry shall establish a user account and an electronic signature authority with the Data Registry. Documentation Authors shall sign the documents they prepare, but documentation author signatures do not indicate or assume responsibility for the truth or validity of the information reported on a compliance document. Documentation Authors may engage in business relationships with the Registration Signers they assist, or they may be employees of the Registration Signers they assist.

JA7.4.5 Field Technician

The Field Technician is responsible for performing the acceptance test procedures and documenting the results of the acceptance tests on a Certificate of Acceptance. The Field Technician shall sign the Certificate of Acceptance to certify that the information he reports on the Certificate of Acceptance is true and correct. When registration of a Certificate of Acceptance is required, the Field Technician shall establish a user account and an electronic signature authority with the Data Registry in order to provide electronic signatures to complete the Certificate of Acceptance.. When a Field Technician also performs the data input to prepare the Certificate of Acceptance documentation, the Field Technician shall also provide the documentation author signature on the Certificate of Acceptance. The Field Technician may be, but is not required to be the installer of the system that requires Acceptance Testing.

JA7.4.6 Registration Signer (Responsible Person)

The Registration Signer is the person responsible for the work described on a compliance document (Certificate of Compliance, Certificate of Installation, Certificate of Acceptance, or Certificate of Verification).

- **For Certificate of Compliance documentation,** the Registration Signer shall be eligible under Division 3 of the Business and Professions Code to accept responsibility for the building design.
- **For Certificate of Installation and Certificate of Acceptance documentation,** the Registration Signer shall be eligible under Division 3 of the Business and Professions Code to accept responsibility for the building construction or installation in the applicable classification for the scope of work described on the document.
- **For Certificate of Verification documentation,** the Registration Signer shall be a certified HERS Rater.

The Registration Signer shall provide a signature to certify that the information reported on a compliance document for which he is responsible is true and correct. When registration of a compliance document is required, the Registration Signer shall establish a user account and an electronic signature authority with the Data Registry. When a Registration Signer also performs the data input to prepare a compliance document, the Registration Signer shall also provide the documentation author signature on the compliance document.

JA7.4.7 Enforcement Agency

Standards Section 10-103(d) requires the Enforcement Agency to verify that all required compliance documents for a project are completed, signed, and submitted or posted as required by Standards Section 10-103(a). Thus, when Section 10-103(a) requires that a compliance document be registered with a Data Registry, the Enforcement Agency must verify that compliance documents submitted when applying for a permit, or posted in the field are registered documents. Such enforcement agency verification shall be by any valid means the Enforcement agency considers satisfactory.

Enforcement Agency persons may establish user accounts with data registries to enable viewing the compliance documents for projects for which their jurisdiction has enforcement authority.

Enforcement Agencies may be authorized to enter notations into project records in data registries to communicate plan check and field inspection information to builders, designers, installers and raters.

JA7.5 Document Registration Requirements

JA7.5.1 Overview

All compliance documents for which registration is required shall be produced by a method approved by the Commission and then registered with an approved Data Registry by authorized users of the Data Registry. Procedures for submittal of required documentation to enforcement agencies and other parties to the building construction project are given in Reference Residential Appendix RA2, and Reference Nonresidential Appendices NA1, and NA10. Standards Section 10-103(a) defines the administrative requirements for the compliance documents (Certificate of Compliance, Certificate of Installation, Certificate of Acceptance, and Certificate of Verification).

Compliance document layouts shall be defined by standardized data structures implemented according to the requirements given in JA7.7. Compliance documents produced by the Data Registry shall conform to the applicable informational content and graphical layout formatting approved by the Energy Commission.

The Data Registry shall be capable of tracking all compliance documentation and maintaining the correct associations between related documents within a building project. Any revisions to compliance documents shall be tracked and reported.

The Data Registry shall ensure that registered documents are retained such that they are available to authorized users for submittals to enforcement agencies or other parties to the building construction project that require copies of the registered compliance documents.

Contingent upon the availability of a Commission Compliance Document Repository, the Data Registry shall immediately and automatically, upon concluding the registration of compliance documents, transmit a copy of each registered compliance document to the Commission Compliance Document Repository.

JA7.5.2 Document Appending

The compliance document informational content, graphical layout, and formatting used by the Data Registry shall conform to the document layouts and data structures approved by the Energy Commission as further described in Section JA7.7. The Data Registry shall be capable of receiving electronic compliance documents and compliance data produced by the methods approved by the Commission, and append the compliance documents received from authorized users according to the requirements in JA7.5.

When data exchange procedures for compliance documents are required, the data definitions and data formatting required by Section JA7.7 shall be used.

Electronic document layouts implemented in Commission-approved methods for producing compliance documents shall include specifications indicating coordinate locations and positions where the Data Registry will affix Registration Signer's Electronic Signatures, registration numbers, registration date and time record information and Data Registry provider logos and watermarks.

The ACM Reference Manual will include additional detailed guidance necessary to assist compliance software tools in providing document output formatted to coordinate with these Data Registry-specific information features.

The following conventions shall be enforced:

JA7.5.2.1 Registration Number

The registration number for a multiple-page document shall be visible on all pages of the document.

JA7.5.2.2 Registration Date and Time

The registration date and time shall reflect the point in time corresponding to the submittal of the electronic certification signature by the person responsible for the information on the document. The format for the

registration date and time record shall be calendar date (year-month-day) with time of day (hour-minutes-seconds). Hour of the day shall utilize 24-hour format. Additional guidance describing the formatting and location for these features may be given in the Data Registry Requirements Manual.

JA7.5.2.3 Performance Compliance Software Calculation Date and Time

The performance compliance calculation date and time information that is generated by the compliance software tool shall be retained as data in the record for the registered Certificate of Compliance document in the Data Registry.

The date and time information for the compliance calculation for a multiple-page performance Certificate of Compliance document shall be visible on all pages of the compliance document.

JA7.5.2.4 Electronic Signatures

Registered documents shall be electronically signed by the documentation authors, and by the persons who are eligible to assume responsibility for the documentation as specified by Standards Section 10-103(a) and who are authorized users of the Data Registry who have established an electronic signature authority with the Data Registry. The Registration Provider shall ensure that all required electronic signature features and procedures specified in Section JA7.6 are implemented and enforced. The electronic signature layouts and locations shall be consistent with the document layouts approved by the Energy Commission. Additional guidance on the location and formatting may be given in the Data Registry Requirements Manual.

JA7.5.2.5 Digital Signatures

The Registration Provider shall ensure that the required digital signature procedures specified in Section JA7.6 are enforced. Guidance for the location for the visible aspects of the registration provider's digital signature may be described in the Data Registry Requirements Manual.

JA7.5.3 Data Validation for Compliance Document Registration

Data Registries shall have the capability to automatically perform validation of data entered by a documentation author to complete a compliance document as required by the document data validation procedures in Section JA7.6.3.2.2.

There shall be a data validation rule set specific to each compliance document.

Detailed guidance for the data validation rules may be provided in the Data Registry Requirements Manual.

Compliance document data validation rules may be implicit in the formatting of the data elements that define a compliance document for data exchange processes, or data validation rules may be implemented by the Data Registry software.

Data validation rules or specifications may be defined in the XML schema that represents the compliance data for a compliance document as further described in Section JA7.7. Validation criteria such as whether data is required or optional, the required data type, the data numeric upper and lower bounds, acceptable enumeration values, calculations that must be performed, etc., can all be defined in the XSD file.

The Data Registry Requirements Manual will provide guidance for the methods for validation of the data taking into consideration the specifications for the data elements for the data exchange processes described in Section JA7.7.

The Data Registry may flag data entry errors at any time during data entry, however all data validation shall be completed prior to allowing a documentation author signature action to be completed. Documents shall not be marked as ready for registration signing unless all required data validation errors have been corrected, and a documentation author signature action has been completed successfully.

The following conventions shall be enforced as a condition for registration of a document:

JA7.5.3.1 Null Entries

When completion of a compliance document requires data entry for an information field, the data shall be entered, otherwise registration shall not be allowed. However, if data entry for a particular information field is optional, a null entry shall not prevent registration from concluding.

JA7.5.3.2 Calculated Values

Whenever possible or practical, the Data Registry shall perform the calculations required for determining compliance results. Guidance for calculations may be given in the Data Registry Requirements Manual.

JA7.5.3.3 Look-up Functions for Calculations

Whenever possible or practical, the Data Registry shall use lookup functions that provide values needed for completing calculations as referenced from the applicable protocols in the Reference Appendices or from Standards compliance criteria. Guidance for application of lookup functions may be given in the Data Registry Requirements Manual. .

JA7.5.4 Registration Numbering Conventions

Registration numbers used for the document registration procedures described in Joint Appendix JA7 are alphanumeric sequences of digits and delimiters that are appended to a compliance document when the document's registration signer performs an electronic signature action in the Data Registry to conclude the registration procedure for a document. Each registration number shall be unique to only one document. The registration numbering convention assigns significance to certain digits in order to define the document type, document revision level, and the parent-child relationships between the compliance documents contained in a project. As the compliance document types required for residential projects are different than those required for nonresidential projects, the numbering conventions used shall conform to the conventions specified in sections JA7.5.4.1 and JA7.5.4.2 respectively.

Registration numbering conventions for other documentation processes are possible. Any new document process for which the Commission requires the documents to be registered shall use a registration numbering convention that is approved by the Commission.

JA7.5.4.1 Nonresidential Registration Numbering Convention

Contingent upon approval of nonresidential Data Registries, a nonresidential registration numbering convention shall be determined and approved by the Commission in conjunction with the approval of the first nonresidential data registry, and shall be used by all nonresidential data registries thereafter. The nonresidential registration numbering convention specification shall use a similar design concept as used in the residential registration numbering convention specified in Section JA7.5.4.2 which assigns significance to digits in order to define the document type, document revision level, and the relationships between the compliance documents contained in a project.

JA7.5.4.2 Residential Registration Numbering Convention

The registration numbers assigned to residential compliance documents by the Data Registry at the conclusion of the registration process shall conform to the conventions described in this section. Refer to Figure JA7.5-1 for information that defines the numbering convention, and an example registration number.

1	provider (1=CHEERS; 2=CaICERTS; 3=CBPCA; sequential)
1	year digit 3 of 4 (eg 3rd digit of year 2013 is shown in example below)
3	year digit 4 of 4 (eg 4th digit of year 2013 is shown in example below)
- delimiter	
N	CC Type (N=new residential, A=alteration residential, D=additional residential)
0	numeric (sequential 0 through 9)
0	numeric (sequential 0 through 9)
0	numeric (sequential 0 through 9)
7	numeric (sequential 0 through 9)
3	numeric (sequential 0 through 9)
2	numeric (sequential 0 through 9)
1	numeric (sequential 0 through 9)
B	Revision Level (alpha only: A=first issuance; then sequential B through Z)
- delimiter	
M	CI Type (E=envelope, L=lighting, M=mechanical)
2	CI Type (first numeric digit eg "2" from the mech-21)
1	CI Type (second numeric digit eg "1" from the mech-21)
0	numeric (sequential 0 through 9)
0	numeric (sequential 0 through 9)
0	numeric (sequential 0 through 9)
5	numeric (sequential 0 through 9)
2	numeric (sequential 0 through 9)
A	Revision Level (alpha only: A=first issuance; then sequential B through Z)
- delimiter	
M	CV Type (E=envelope, L=lighting, M=mechanical)
2	CV Type (first numeric digit eg "2" from the mech-21)
1	CV Type (second numeric digit eg "1" from the mech-21)
C	Revision Level (alpha only: A=first issuance; then sequential B through Z)

9,999,999 numbers + 0	
Certificate of Compliance (CC)	
use 000000000 for CC documents	

99,999 numbers	
Certificate of Installation (CI)	
use 000000000 for CI documents	

99,999 numbers	
Certificate of Verification (CV)	
use 0000 for CV documents	

Use only capitalized alpha digits; Omit use of the letter "O" to avoid confusion with the number Zero "0"; Omit use of the letter "I" to avoid confusion with the number One "1";

Figure JA7.5-1. Residential Registration Numbering Convention (and Example Number)

As shown in Figure JA7.5-1, the significance of the digits provides descriptors for: the registration provider; the year; the type of compliance document; relationships between the documents; and the revision level of the respective documents. The digit type (Alpha or Numeric) and sequencing are also given.

The following are examples of registration numbers and the interpretation of the significance of the numbering as consistent with the descriptions given in Figure JA7.5-1.

113-N0007321B-000000000-0000: CHEERS provider, 2013 year project, residential new construction Certificate of Compliance document type, and sequential number 0007321, revision B.

113-N0007321B-M2100052A-0000: Certificate of Installation document type associated with the above Certificate of Compliance #113-N0007321B-00000000-0000, MECH-21 Certificate of Installation type, and sequential number 00052, revision A.

113-N0007321B-M2100052A-M21C: -Certificate of Verification associated with the above Certificate of Installation #113-N0007321B-M2100052A-0000, MECH-21 HERS Certificate of Verification document type, revision C.

JA7.5.5 Verification of Authenticity of Copies of Registered Documents

For projects for which Standards Section 10-103(a) requires the documents to be registered, compliance requires that documents shall first be registered with a Data Registry before being submitted to an enforcement agency for approval. Additionally, when revisions to the compliance documents are necessary, compliance requires the revised documents to be registered with the Data Registry prior to re-submittal to the enforcement agency for approval. Thus, the current revision of a registered document in the Data Registry shall be the reference document for validation of the authenticity of a document submitted to an enforcement agency or to another party to the construction project.

Registration Providers shall make available document verification services to authorized users of their Data Registry.

Methods for verification of a document's authenticity shall include basic visual comparison of a copy of a registered document to the current version of the registered document on file in the Data Registry.

Additionally, the automated document validation utility that is made possible by digital signature technology makes it possible for a document recipient to automatically verify an electronic copy of a registered compliance document without having to manually inspect it against the registered document in the Data Registry. As described in Section JA7.3, the last step in the document registration procedure in the registry applies the registration provider's digital certificate containing their digital signature to the entire compliance document, thus providing the capability for automated verification of authenticity of electronic copies of the registered document.

Additional guidance for use of the Data Registry digital signature technology for verification of document authenticity may be given in the Data Registry Requirements Manual, and in the Residential and Nonresidential Compliance Manuals.

JA7.5.6 Project Document Configuration

Data Registries shall be capable of tracking all compliance documentation and maintaining the correct associations between related documents, including revisions and completion statuses for all documents within a building project.

A certificate of compliance establishes the requirements for project documentation for prescriptive and performance compliance methods.

2013 Standards introduced mandatory HERS verification for residential projects for which there are options for compliance with the mandatory requirement. Thus, indication of the option selected for compliance with a residential mandatory measure may not be known until after a Certificate of Installation is submitted to a Data Registry to demonstrate compliance with the mandatory requirement. The Data Registry shall track when Certificate of Installation documents are registered for any mandatory measure that has an option for compliance; shall report any HERS verification requirement that is triggered by the mandatory measure; and ensure that any required HERS verification is completed as a condition of compliance. Additional guidance describing residential data registry tracking of mandatory measure options, and the required documentation for the mandatory options may be provided in the Data Registry Requirements Manual.

JA7.5.6.1 Project Status Reports

The status of completion of a project shall be reported by the Data Registry.

The Data Registry shall determine the documents required for a project based on the Certificate of Compliance and maintain a summary that reflects the current status of completion of the required documents and shall be readily accessible to authorized users of the Data Registry. Access to the report shall be facilitated by use of search parameters relevant to the project as listed in Sections JA7.5.6.1.1 and JA7.5.6.1.2.

Enforcement Agencies may be authorized to enter notations into project records in data registries to communicate plan check and field inspection information to builders, designers, installers and raters.

The project status report shall be made available in a printable format.

Minimum information requirements for the project status report shall include the following:

JA7.5.6.1.1 Project Status Report Information for Residential Projects:

- Project name
- Project address
- Listing of the Certificate of Compliance documents required; date registered (or indicate not complete if the document record has been started but is not yet registered); registration number
- Listing of the Certificate of Installation documents required; date registered (or indicate not complete if the document record has been started but is not yet registered); registration number
- Listing of the Certificate of Verification documents required; date registered or indicate not complete if the document record has been started but is not yet registered); registration number
- Listing of the mandatory measure options required; options selected (refers to the Certificate of Installation and Certificate of Verification documentation).

JA7.5.6.1.2 Project Status Report Information for Nonresidential Projects:

Note: Nonresidential Document registration is contingent upon approval of a nonresidential Data Registry by the Commission, and the requirement for nonresidential document registration is not effective until January 1, 2015.

- Project name
- Project address
- Listing of the Certificate of Compliance documents required; date registered (or indicate not complete if the document record has been started but is not yet registered); registration number
- Listing of the Certificate of Installation documents required; date registered (or indicate not complete if the document record has been started but is not yet registered); registration number
- Listing of the Certificate of Acceptance documents required; date registered (or indicate not complete if the document record has been started but is not yet registered); registration number
- Listing of the Certificate of Verification documents required; date registered (or indicate not complete if the document record has been started but is not yet registered); registration number

JA7.5.6.2 Revision Control

When a revision to a compliance document is made, the revised version of the compliance document shall also be registered (a registration signer must sign again to register the revision), and the revision digit for the compliance document shall be incremented. Thus a copy of each registered revision of each registered document shall be transmitted to the Commission Compliance Document Repository.

When a revision to a compliance document that has registered "child" documents is performed, the "child" documents shall be stripped of their registered status and shall remain "orphaned" until signed again by the registration signer subsequent to making any necessary changes to the "orphaned child" document caused by the revision of the "parent" document. A new registration signature is required for the orphaned child in order to update the registration number to reflect the revision of both the parent and the child documents.

A copy of the new revision of a document shall be submitted to the enforcement agency for all applicable approvals or inspections.

The data that was used to create obsolete versions of compliance documents shall not be required to be retained in the Data Registry history or memory. However, a copy of each revision of each registered electronic document shall be retained.

The current revision of any document in the registry shall be considered to be the only valid version of that document. All previous revisions of that document shall be considered obsolete, thus not valid for use for submittal to enforcement agencies to demonstrate compliance.

JA7.5.7 Certificate of Compliance Requirements

JA7.5.7.1 Prescriptive Certificate of Compliance Document

Procedures for submittal of prescriptive Certificate of Compliance documents may be by direct keyed-in data entry as described in Section JA7.7.1.1, or by other methods if approved in accordance with Section JA7.8. Guidance for the procedures and requirements for Data Registry features for prescriptive certificate of compliance document registration may be given in the Data Registry Requirements Manual.

JA7.5.7.2 Performance Certificate of Compliance Document:

Procedures for submittal of the performance Certificate of Compliance shall use approved features of a Data Registry as described in Section JA7.8, and shall conform to the data exchange requirements given in Section JA7.7.1.2.

JA7.5.7.3 Multiple Orientation Plans (Residential)

The Data Registry shall ensure that multiple orientation performance Certificate of Compliance documents are configured in the Data Registry such that the registered multiple orientation Certificate of Compliance document is referenced for all build-outs of that master plan. The registered Certificate of Compliance that was approved by the enforcement agency shall be the Certificate of Compliance document that is the parent document for each and every dwelling unit built from that master plan.

Detailed guidance describing the procedures for tracking revisions to multiple orientation Certificate of Compliance Documents may be given in the Data Registry Requirements Manual.

JA7.5.7.4 Multifamily Dwelling units

The Data Registry shall ensure that multifamily whole-building performance Certificate of Compliance documents are configured in the Data Registry such that the registered multifamily Certificate of Compliance document is referenced for all dwelling units in the multifamily building. The registered Certificate of Compliance that was approved by the enforcement agency shall be the Certificate of Compliance document that is the parent document for each and every dwelling unit specified by that whole-building certificate of Compliance document.

Detailed guidance describing the procedures for tracking revisions to multifamily whole-building Certificate of Compliance Documents may be given in the Data Registry Requirements Manual.

JA7.5.8 Certificate of Installation Requirements

JA7.5.8.1 Residential Certificate of Installation

Procedures for submittal of residential Certificate of Installation documents may be by direct keyed-in data entry as described in Section JA7.7.1.1, or by other methods if approved in accordance with Section JA7.8. Detailed guidance for the functional and technical elements necessary for registration of residential Certificate of Installation for a Data Registry may be given in the Data Registry Requirements Manual.

JA7.5.8.2 Nonresidential Certificate of Installation

Nonresidential Certificate of Installation document registration is contingent upon the approval of nonresidential Data Registries, and in any event shall not be required before January 01, 2015.

Procedures for submittal of Nonresidential Certificate of Installation documents may be by direct keyed-in data entry as described in Section JA7.7.1.1, or by other methods if approved in accordance with Section JA7.8. Detailed guidance for the functional and technical elements necessary for registration of Nonresidential Certificate of Installation documents for a Data Registry may be given in the Data Registry Requirements Manual.

JA7.5.9 Certificate of Verification Requirements

Certificate of Verification documents are always registered documents.

Procedures for submittal of Certificate of Verification documents may be by direct keyed-in data entry as described in Section JA7.7.1.1, or by other methods if approved in accordance with Section JA7.8. Detailed guidance for the required functional and technical elements necessary for registration of Certificate of Verification documents for a Data Registry may be given in the Data Registry Requirements Manual.

JA7.5.9.1 Managing Sample Groups

HERS Provider Data Registries are required to manage the group sampling procedures. Details that describe the requirements for managing sample groups are given in Reference Residential Appendix RA2 and in Reference Nonresidential Appendix NA1.

JA7.5.9.2 Group Numbering Convention

Group number is a HERS provider-designated identification number unique to the sample group to which a dwelling has been assigned. The providers shall utilize the numbering convention given in Figure JA7.5-2, below. The group number shall be reported on all Certificate of Verification documents that utilize group sampling for compliance.

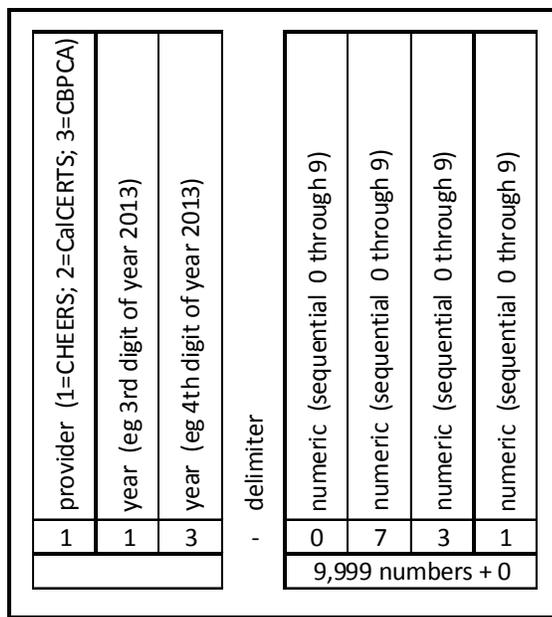


Figure JA7.5-2. Group Numbering Convention (and Example Number)

The following is an example group number and the interpretation of the significance of the numbering consistent with the descriptions given in Figure 4-1.

113-0731: CHEERS, group opened during year 2013, sequential group number 0731

JA7.5.10 Certificate of Acceptance Requirements

Certificate Acceptance document registration is contingent on the approval of nonresidential Data Registries, and in any event shall not be required before January 01, 2015.

Procedures for submittal of Certificate Acceptance documents may be by direct keyed-in data entry as described in Section JA7.7.1.1, or by other methods if approved in accordance with Section JA7.8. Detailed guidance for the required functional and technical elements necessary for registration of Certificates of Acceptance documents for a Data Registry may be given in the Data Registry Requirements Manual.

JA7.6 Electronic and Digital Signature Requirements

JA7.6.1 Introduction

This section defines the functional and technical requirements for the use of electronic and digital signatures in the registration of compliance documents. These specifications shall be implemented by a Data Registry as a condition of approval of the Data Registry by the Commission or the Executive Director

JA7.6.2 Overall Description

JA7.6.2.1 Interfaces - Main Users

- Authorized Users of Data Registries who must sign Compliance Documents either as the Documentation Author, or Field Technician, or as the Registration Signer (responsible person).
- Registration Providers who must implement the electronic and digital signature specifications into the Data Registry user interface to provide Electronic Signature capabilities to the Authorized Users of the Data Registry, and must append their digital signature to all registered compliance documents created in their Data Registry.
- Commission Compliance Document Repository which must receive registered documents transmitted from the Data Registries and will process the digital signature to validate the sender and the contents.
- Persons or Software Entities who Validate Electronic Documents who may receive electronic copies of registered documents made available by the Data Registries and will process the digital signature to validate the sender and the contents.
- Compliance Software Tools that export compliance documents for transmittal to the Data Registries that must subsequently be electronically signed and registered in the data registry.

JA7.6.2.2 Major Functions

The electronic and digital signature requirements of the HERS registry consist of the following major functions:

JA7.6.2.2.1 Electronic Signature Capability

The Data Registry shall provide electronic signature capability to authorized users.

JA7.6.2.2.2 Document Data Validation

The Data Registry shall check that compliance documents are complete and the data entered meets the data validation rules for the applicable document before making the documents available for signing or registering.

JA7.6.2.2.3 Signer Review and Signature Actions

The Data Registry shall provide functionality for authorized users to select, review, and sign compliance documents as a Documentation Author, Field Technician, or Registration Signer.

JA7.6.2.2.4 Digital Signatures

The Data Registry shall apply the Registration Provider's Digital Signature to compliance documents electronically signed by the registration signer when concluding the document registration procedure in the Data Registry and then append the Registration Provider's digital certificate issued by a certificate authority approved by the California Secretary of State.

The function of the Registration Provider's digital certificate is to provide verification from an approved certificate authority that the document came from the Registration Provider's Data Registry and to provide

automated document validation to persons or agencies that receive electronic submittals of these registered documents.

JA7.6.2.2.5 Transmittal to Commission Compliance Document Repository

The Data Registry, upon completion of the registration procedure, shall immediately and automatically transmit a copy of the completed registered compliance document to the Commission Compliance Document Repository which will process the registration provider's digital certificate to validate the sender and the compliance document contents.

JA7.6.2.2.6 Document Retention

The Data Registry shall retain a copy of the completed registered electronic compliance document and make the document available for use by authorized users of the registry who may access a copy of the registered document and may subsequently process the Registration Provider's digital certificate to validate the sender and the compliance document contents.

JA7.6.2.2.7 Receive and Process Output From Compliance Software and Other Software Tools

The Data Registry shall process the completed Compliance Registration Package from Compliance software tools or other software tools approved by the Commission or the Executive Director for use in the Compliance Document Registration process.

JA7.6.2.3 User Characteristics

There are four categories of users who will participate in the electronic and digital signature functionality:

JA7.6.2.3.1 Users who will use electronic signatures to sign and register compliance documents.

This is a heterogeneous category composed of HERS raters, building designers, building contractors, installation contractors, energy consultants, home owners, and others.

JA7.6.2.3.2 Users who use a digital certificate to secure registered compliance documents.

This category consists of each approved Registration Provider.

JA7.6.2.3.3 Users who will receive the electronically transmitted registered compliance documents

These users will need to apply decryption processing using the digital certificate to identify the sender and verify the contents of the received document. The Commission Compliance Document Repository is a main user in this category. Also, users who take advantage of digital signature automated validation capabilities to verify the authenticity of registered compliance documents received as electronic submittals from various other participants in the compliance documentation process will be another main user in this category.

JA7.6.2.3.4 Users who transmit electronic compliance documentation to the Data Registry.

Title 24 compliance software tools are the main users in this Category. The electronic compliance documents exported from the compliance tools must be formatted to provide location coordinate information for use when applying the visible aspects of electronic and digital signatures to the compliance documents. The Data Registry must be capable of appending the visible aspects of electronic and digital signatures to the correct locations in the signature blocks on the imported compliance documents during the subsequent electronic signature and registration procedures.

Detailed guidance for electronic and digital signature target coordinate information may be described in the 2013 Alternative Calculation Method (ACM) Reference Manual to assist in the implementation of the requirements by compliance software vendors. The Data Registry will need to implement the capability to append the visible aspects of electronic and digital signatures to the signature blocks on compliance documents in these locations.

JA7.6.2.4 Constraints

JA7.6.2.4.1 Schedule Constraint:

The electronic and digital signature capabilities shall be implemented at least six months before the effective date for the 2013 Standards.

JA7.6.2.4.2 Software Constraint:

The digital signature technology including the hash algorithm and asymmetric key encryption used shall be consistent across all Data Registries because the Commission Compliance Document Repository will not support multiple approaches.

JA7.6.3 Specific requirements

JA7.6.3.1 Interface Requirements

JA7.6.3.1.1 User interfaces

JA7.6.3.1.1.1 All Data Registries shall utilize the same informational content, graphical layout and formatting unique to the applicable type of compliance document when displaying the completed compliance documents for review and signing as part of the registration process. These document layouts shall conform to the informational content, graphical layout and formatting approved by the Commission. Additional detailed guidance regarding informational content, graphical layout and formatting will be presented in the Data Registry Requirements Manual.

JA7.6.3.1.2 Software interfaces

JA7.6.3.1.2.1 All registered compliance documents transmitted from any Data Registry shall be secured with the Registration Provider digital signature.

JA7.6.3.1.2.1.1 All Data Registries shall use the same hash algorithm to generate the document's message digest for the digital signature.

JA7.6.3.1.2.1.2 All Data Registries shall use the same asymmetrical key encryption for generating the digital signature private and public keys used to encrypt and decrypt the message digest.

JA7.6.3.1.2.1.3 Registration Providers shall provide their digital certificate which contains their digital signature public key to any other software entity that receives registered compliance documents from their Data Registry, in particular the Commission document repository.

JA7.6.3.1.2.1.4 The Commission document repository, which will receive registered compliance documents electronically from Data Registries, will have to implement digital signature processing capability in order to perform automatic verification and validation processing on received documents.

JA7.6.3.1.2.1.5 Users who take advantage of digital signature automated validation capabilities to verify the authenticity of registered compliance documents received from Data Registries will have to implement digital signature processing capability in order to perform automatic verification and validation processing on received documents. The Adobe Reader software tool, which is freeware, has the capability to process the digital signatures for any digitally signed documents that utilize standardized digital signature technology.

JA7.6.3.1.2.2 All Data Registries shall implement the same security protocol for importing completed compliance document transmittals generated by 3rd party software tools. The security protocol shall be approved by the Commission.

JA7.6.3.1.2.2.1 Guidance shall be provided in the 2013 ACM Reference Manual and the 2013 Data Registry Requirements Manual to assist all 3rd party software entities in implementing the required security protocols.

JA7.6.3.2 Functions

JA7.6.3.2.1 Electronic Signature Capability

The Data Registry shall provide electronic signature capability to authorized users who have the role of Documentation Author, Field Technician, or Registration Signer. A Field Technician Signature is required only on Certificate of Acceptance Documentation. A Certificate of Acceptance document requires that there be both a Documentation Author signature and a Field Technician signature prior to registration signing.

JA7.6.3.2.1.1 Any authorized user of a Data Registry can request an electronic signature in order to sign compliance documents as the documentation author, Field Technician, or as the registration signer.

JA7.6.3.2.1.2 Registration Providers shall gather and verify any and all information necessary to validate a user applicant's identity and applicable qualifications as prerequisite to authorizing assignment to a user applicant an electronic signature, or permissions as a documentation author, Field Technician, or Registration Signer.

JA7.6.3.2.1.3 Authorized users shall provide to the Data Registry an electronic image of their handwritten signature for use in displaying their electronic signature.

JA7.6.3.2.2 Document Data Validation

The Data Registry shall check that compliance documents are complete and shall perform the required data validation for the document before making them available for signing and/or registering. The guidance for the data validation for each document shall be provided in the Data Registry Requirements Manual.

Any applicable error messages shall be posted indicating the actions necessary as prerequisite to completion of the registration process.

JA7.6.3.2.2.1 When a documentation author indicates that the compliance document is complete and he/she is ready to sign it, the Data Registry shall verify that all information necessary to complete the document has been provided as prerequisite to making the signing functionality available to the documentation author.

JA7.6.3.2.2.2 The Data Registry shall verify that a compliance document is complete and has received the documentation author's signature as prerequisite to making the compliance document available for registration signing. For Certificate of Acceptance documents, both the Documentation Author and the Field Technician signatures shall be provided as prerequisite to making the document available for registration signing.

JA7.6.3.2.3 Signer Review and Signature Actions

The Data Registry shall provide functionality for authorized users to select, review and sign compliance documents as a documentation author, field technician, or registration signer.

JA7.6.3.2.3.1 The documentation author can electronically sign a compliance document if it has been verified as complete by the Data Registry.

JA7.6.3.2.3.2 The Field Technician can electronically sign a Certificate of Acceptance document if it has been verified as complete by the Data Registry and has the documentation author's signature.

JA7.6.3.2.3.3 The registration signer can electronically sign a compliance document if it has been verified as complete by the Data Registry and has the documentation author's signature. For Certificate of Acceptance documents both the Documentation Author signature and the Field Technician signature are prerequisite to allowing registration signing.

JA7.6.3.2.3.4 When an authorized user selects to sign a compliance document, the Data Registry provides a display of the compliance document layout that allows the user access to any part of the compliance document for review, as well as a display of the declaration statement.

JA7.6.3.2.3.4.1 All compliance documents shall include a declaration statement applicable to the documentation author signature. The declaration statement language shall be approved by the Commission.

JA7.6.3.2.3.4.2 All Certificate of Acceptance documents shall include a declaration statement applicable to the field technician signature. The declaration statement language shall be approved by the Commission.

JA7.6.3.2.3.4.3 All compliance documents shall include a declaration statement applicable to the registration signer signature. The declaration statement language shall be approved by the Commission.

JA7.6.3.2.3.4.4 All compliance document layouts displayed shall conform to the same format, informational order, and content approved by the Commission. Guidance for data and layout specifications shall be published in the data registry requirements manual.

JA7.6.3.2.3.5 When the documentation author activates the signing control to sign the compliance document, the Data Registry shall display the completed documentation author signature block including the documentation author's electronic signature utilizing the visible image of his or her hand written signature, applicable professional qualifications, licenses and/or certificates the documentation author holds, and the date and time the document was signed.

JA7.6.3.2.3.6 When the Field Technician activates the signing control to sign the Certificate of Acceptance document, the Data Registry shall display the completed field technician's signature block including the documentation author's electronic signature utilizing the visible image of his or her hand written signature, applicable professional qualifications, licenses and/or certificates the Field Technician holds, and the date and time the document was signed.

JA7.6.3.2.3.7 When the registration signer activates the signing control to register the compliance document, the Data Registry shall display the completed signature block including the registration signer's electronic signature utilizing the visible image of his or her hand written signature, applicable professional qualifications, licenses or certificates the registration signer holds, the date and time the document was signed, with the newly generated registration number appended to the footer of each of the pages of the document. The registration numbering convention shall conform to the requirements given Reference Joint Appendix JA7.

JA7.6.3.2.4 Digital Signatures

The Data Registry shall apply the Registration Provider digital signature to compliance documents electronically signed by the registration signer and then append the Registration Provider's digital certificate containing their public key, when concluding the document registration procedure in the Data Registry.

JA7.6.3.2.4.1 When a compliance document is electronically signed by the registration signer, the Data Registry shall apply a visible indication of the Registration Provider's digital signature to the

document which shall include the following statement: "This digital signature is provided in order to secure the content of this registered document, and in no way implies Registration Provider responsibility for the accuracy of the information".

JA7.6.3.2.4.1.1 The Data Registry digital signature software generates a hash number from the contents of the registered compliance document to create the message digest part of the digital signature.

JA7.6.3.2.4.1.2 The Data Registry digital signature software encrypts the message digest using the Registration Provider's digital signature private key to produce the digital signature.

JA7.6.3.2.4.1.3 The Data Registry digital signature software attaches the Registration Provider's digital certificate which contains their digital signature public key to the compliance document, displays the Registration Provider name and logo on each page of the document, and the digital signature's date and time stamp in the footer of each page of the compliance document.

JA7.6.3.2.5 Transmittal to Commission Compliance Document Repository

The Data Registry, upon completion of the registration procedure, shall immediately and automatically transmit a copy of the completed registered compliance document to the Commission Compliance Document Repository which will process the Registration Provider's digital signature using the Registration Provider's digital certificate to validate the sender and the compliance document contents.

JA7.6.3.2.5.1 The Data Registry shall transmit the digitally signed and registered compliance document to the Commission document repository using a secure transmission protocol. Detailed guidance for the secure transmission protocol may be specified in the Data Registry Requirements Manual.

JA7.6.3.2.6 Document Retention

The Registration Provider shall retain a copy of the completed registered compliance document and make the document available for use by authorized users of the registry who may print a hard copy, or access an electronic copy of the registered document and may subsequently process the Registration Provider's digital signature using their digital certificate to validate the sender and the compliance document contents.

JA7.6.3.2.6.1 The Data Registry shall provide users the functionality to either view registered documents in their web browser or save the document file to their desktop.

JA7.6.3.2.6.2 The Data Registry shall provide functionality to transmit registered compliance documents to authorized requesters.

JA7.6.3.2.6.3 The Data Registry shall make their digital signature public key available for all types of authorized access to these registered documents.

JA7.6.3.2.7 Receive and Process Output From Compliance Software or Other Software Tools

The Data Registry shall process the Compliance Registration Package transmitted from compliance software tools or other software tools approved by the Commission for use in compliance document registration processes.

JA7.6.3.2.7.1 The Data Registry shall have functionality to receive data containing electronic documents and data exported from compliance software tools or other software tools approved by the Commission. When data is received using a password protected encrypted file, the file password shall be made available to the Data Registry by the software vendor in a separate secure communication. Additional guidance may be provided in the Data Registry Requirements Manual. The passwords for encrypted data files shall not be made available to the software users or the Data Registry authorized users, or others who do not have the authority to administer the security measures for the compliance software or the registries.

There may be alternate means by which Compliance Software tools or other software tools approved by the Commission could communicate with Data Registries such as by a Web Service application that may not use encrypted data files, but rather data streaming. Use of such alternate means shall not be allowed unless approved by the Commission.

JA7.6.3.2.7.2 The Data Registry shall have functionality to decrypt data files it receives that contain completed compliance documents exported from compliance software tools or other software tools approved by the Commission using the password provided by the software vendor. If the password successfully decrypts the file, the Data Registry shall add the compliance document to the registry. Additional guidance describing methods for decrypting data files will be given in the Data Registry Requirements Manual. If the password fails to decrypt the transmitted file, the Data Registry shall display an error message to that effect, and flag any other applicable corrective actions as may be described in the Data Registry Requirements Manual.

JA7.6.3.2.7.3 The Data Registry shall only allow the transmission of data between compliance software tools or other software tools approved by the Commission using secure data transfer protocols. Detailed guidance for secure data transfer protocols may be given in the Data Registry Requirements Manual.

JA7.7 Data Exchange Requirements

Compliance documents are based on standardized data structures that define the content and layout contained for the standard reports that are required by the Administrative Regulations (Title 24, Part 1, §10-103). These data structures will be represented using XML, a well established public data exchange standard developed by the World Wide Web Consortium. All software that generates data used for producing compliance documents, including Data Registries that provide software interfaces for both keyed data entry or data transmission from external systems will be required to use this technology. Specifically, the data that represents the content in compliance documents will be expressed as XML data which is validated against an XML schema that shall be approved by the Energy Commission. The XML schema will standardize the organization of the data and the terminology and data types, which will strengthen data integrity and provide built-in data validation. As an industry standard for data exchange, using XML technology will take advantage of support from numerous XML read and write software tools that are available in all major development environments.

The compliance document images rendered from the data in the XML document shall be consistent with the informational content and graphical layout formatting for the compliance documents approved by the Commission.

Detailed Guidance for use of the data definitions defined in the XML schema, and data formats used to render each of the registered compliance documents utilized for data exchange procedures for the compliance documents shall be provided in the Data Registry Requirements Manual. Consideration shall be given to use of two complimentary XML technologies, Extensible Stylesheet Language Transformation (XSLT) and Extensible Stylesheet Language Formatting Objects (XSL-FO) which would work directly with the data in the Compliance Data Exchange File to transform the data into the required graphical layout for the compliance document.

Data registries shall provide web-based services to authorized users to enable data exchange between the Data Registry and the authorized user's computer system(s).

Data exchange transactions used for Data Registry document registration processes shall be transactions that utilize technology or software that has been approved by the Commission in accordance with Section JA7.8 or JA7.9. Use of technology or software that has not been approved by the Commission shall not be allowed.

JA7.7.1 Data Exchange Requirements for Document Registration

JA7.7.1.1 Keyed-in Data Entry

Data Registries shall have the capability to receive data input transmitted from an authorized user's computer system keyboard entry devices and pointing devices when the authorized user has logged on to the Data Registry web service.

JA7.7.1.2 Imports from Software Tools External to a Data Registry

For document registration procedures that require electronic data or image files be transmitted to a Data Registry, the electronic data or image file transmittals shall conform to the data exchange requirements specified by Section JA7.7.

Note: Any software tool that utilizes data transmission to a Data Registry for purposes of document registration in a Data Registry shall be approved for use in accordance with all applicable requirements in Section JA7.8.

JA7.7.1.3 Image File Format for Document Registration

Image files transmitted to a Data Registry as part of document registration procedures shall be non-editable "flat" image files in pdf format. Registered document images produced by a Data Registry shall be non-editable "flat" image files in pdf format. The pdf image shall not be recreated from data every time a user wishes to view the registered document. The image shall be generated only once, and stored as a "non-editable" image file.

JA7.7.1.4 Export to Commission Compliance Document Repository

Contingent upon approval of a document repository by the Executive Director, upon conclusion of the registration of a document, the Data Registry shall immediately and automatically export a copy of the registered compliance document to the Commission Document Repository. The export shall conform to the specifications for data exchange described in JA7.7 and consist of an XML file which is validated against an XML schema that shall be approved by the Energy Commission. Detailed guidance for data and document exports to the document repository may be included in the Data Registry Requirements Manual.

Exports to the Commission Compliance Document Repository shall have both data and image descriptions of the registered compliance document.

JA7.7.1.5 Electronic Copies of Registered Compliance Documents for Submittals

Registered document files retained by a Data Registry shall be made available to authorized users of the Data Registry for download for use for electronic submittals. These electronic copies of the registered compliance documents shall have the Registration Provider's digital signature which provides for automatic electronic validation of the authenticity of the document. Refer to Section JA7.5.5 for more information about automatic verification of document authenticity using digital certificates.

JA7.8 Data Registry Approval

This section explains the requirements for approval of Data Registries that provide services to authorized users for creating and registering documents required for compliance with Part 6.

The Commission shall perform acceptance testing of Data Registries when a registration provider applicant submits an application in order to determine if the requirements in Reference Joint Appendix JA7 have been met.

Detailed guidance for approval of data registries may be provided in the Data Registry Requirements Manual.

JA7.8.1 Overview

The approval procedure requires self-testing and self-certification by the Registration Provider applicant. The Registration Provider applicant shall conduct the specified tests, evaluate the results and certify in writing that the Data Registry passes the tests. The Commission shall perform spot checks and may require additional tests to verify that the proposed Data Registry is suitable for use for providing the compliance document registration functionality required by the Standards. The registration provider shall develop a user manual or online help screens that explain how to perform the document registration procedures offered by the Data Registry. The user manual or online help screens shall be reviewed by the Commission for accuracy and ease of use.

JA7.8.2 Application Checklist

The following is a list of the items that shall be included in an application package for Data Registry certification by the Commission:

JA7.8.2.1 Registration Provider Applicant Certification Statement.

A statement from the Registration Provider applicant certifying the reliability and accuracy of the Data Registry when used for registration of Compliance Documents in accordance with the requirements of Standards Section 10-103(a), Reference Joint Appendix JA7, and may reference the guidance given in the Data Registry Requirements Manual.

The template for the Registration Provider Certification Statement document may be published in the Data Registry Requirements Manual, and electronic versions of the Registration Provider Certification Statement template shall be made available to Registration Provider applicant upon request.

JA7.8.2.2 Compliance Document Registration Test Results.

Electronic copies of the results of the data exchange verification tests, and electronic copies of the registered documents that result from the document registration tests shall be provided. Detailed guidance to assist the applicant in performing and reporting the standardized tests may be given in the Data Registry Requirements Manual.

JA7.8.2.3 User Manual

A copy of the user manual for the Data Registry shall be provided in an electronic format that can be utilized by word processing software. Help screens from the data registry user interface, organized into an electronic document file with a table of contents is an acceptable alternative to the requirement for a user manual.

JA7.8.2.4 Data Registry Authorized User Account Access.

User name and password information shall be provided to allow access to the Data Registry for Commission staff to perform verification of Data Registry functionality.

The Registration Provider's digital signature public key shall be provided in order that their digital signature on registered documents can be tested.

JA7.8.2.5 Application Fee and Other Administrative Requirements

Refer to Standards Section 10-109 for required application fees and additional administrative requirements applicable to approval of data registries.

JA7.8.3 Types of Approval

There are two Data Registry approval procedures: full approval, and amendment to full approval. Full approval is required for all Data Registry changes unless they qualify for the amendment to full approval procedure.

JA7.8.3.1 Full Approval

Full approval is required when an applicant Data Registry service has not previously been approved by the Commission. Additionally, the Commission may require that all Data Registries conform to the requirements of a full approval procedure when the Standards are updated (re-approval), or whenever substantial changes are made to a Data Registry's functionality, security, or technology features. When Data Registry re-approval is mandated by the Commission, all Registration Providers shall be notified of the re-approval timetable. A revised Data Registry Requirements Manual- may be published to provide guidance for the re-approval process.

Full approval shall ensure the data registry conforms to all applicable requirements for functionality and security in JA7 including but not limited to:

- capability to produce and manage registered documents (JA7.5)
- Electronic signature capability, and manage authorization of users (JA7.6.3.2.1)
- Document data validation (JA7.6.3.2.2)
- Signer review and signature actions (JA7.6.3.2.3)
- Digital signature and digital certificate actions (JA7.6.3.2.4)
- Capability to transmit secured documents and data to the Commission Compliance Document Repository (JA7.6.3.2.5).
- Document retention capability (JA7.6.3.2.6)
- Capability to receive and process secured output files from compliance software and other software tools approved for use for registering compliance documents (JA7.6.3.2.7).
- Capability for data exchange with compliance report generation services approved by the Commission to generate formatted electronic documents (JA7.7).

Detailed guidance to assist with approval procedures may be given in the Data Registry Requirements Manual.

JA7.8.3.2 Amendments

Certain types of changes to Data Registry software applications may be made through a streamlined amendment process. Changes that qualify for amendment approval are changes for which there are minor changes to the document registration procedures, data input requirements, or registered documentation output for the Data Registry. When Data Registry modifications qualify for amendment approval, the following procedure shall be followed:

1. The Registration Provider applicant shall notify the Commission in writing to provide a description of the change and the reason for making the change.

2. The Registration Provider applicant shall prepare an addendum to the user manual describing the change to the Data Registry if applicable.

3. The Commission shall respond to the Registration Provider applicant within 45 days. The Commission response to the applicant may:

- approve the modification;
- request additional information;
- refuse to approve the modification;
- require the Registration Provider to submit results of additional acceptance tests applicable to the modification; or
- require that the Registration Provider make specific changes to either the User Manual addendum or the Data Registry functionality.

The Registration Provider shall submit results of any required validation tests applicable to the modification. It is not necessary to resubmit Data Registry test results previously submitted that remain valid.

Any amendment to an existing Data Registry approval shall be accompanied by a cover letter explaining the type of amendment requested, and copies of any other applicable documents that are required. All items on the application checklist shall be submitted, when applicable. The timetable for approval of amendments is the same as for full approval.

4. With Commission approval, the Registration Provider may make the modified Data Registry available for use for registration of compliance documentation, along with the modified user manual or addendum to the user manual, and shall notify authorized users of the Data Registry.

JA7.8.4 Rescinding Approval (Deactivation) of Data Registries

The Commission may rescind approval of Data Registries through various means.

JA7.8.4.1 Procedures that Initiate Deactivation

1. All Data Registries are deactivated when the Standards undergo substantial changes, usually occurring with each Standards update. However, the data registry shall remain approved to provide document registration for projects that have been permitted under the prior versions of the Standards.

2. Any Data Registry can be deactivated by a letter from the Registration Provider requesting that the Data Registry be deactivated. The deactivation request shall briefly describe the reasons that justify the need for deactivation.

3. Any "initiating party" may commence a procedure to deactivate a Data Registry according to the steps outlined below. The intent is to provide a means whereby serious Data Registry errors, flawed numeric results, improper registered document output not discovered in the Data Registry approval process can be verified, and a corrective course of action determined. In this process, there is ample opportunity for the Commission, the Registration Provider, and all interested parties to evaluate any alleged errors in the Data Registry functionality.

JA7.8.4.2 Challenging a Data Registry and Initiating Deactivation

A description of the process for challenging a Data Registry or initiating a deactivation procedure follows:

1. Any party may initiate a review of a Data Registry approval by sending a written communication to the Commission's Executive Director. (The Commission may be the initiating party for this type of review by noticing the availability of the same information listed here.) The initiating party shall:

(a) State the name of the Data Registry that contains the alleged errors;

(b) Identify concisely the nature of the alleged errors in the Data Registry that require review;

(c) Explain why the alleged errors are serious enough in their effect on document registration compliance to justify a deactivation procedure; and

(d) Include appropriate data electronically (in a format agreed to by the Commission staff) and/or information sufficient to evaluate the alleged errors.

2. The Executive Director shall make a copy or copies of the initial written communication available to the Registration Provider and interested parties within 30 days. Comments from interested parties shall be received within 60 days of the acceptance of the original application.

3. Within 75 days of receipt of the written communication, the Executive Director may request any additional information needed to evaluate the alleged data Registry errors from the party who initiated the deactivation review process. If the additional information is incomplete, this procedure will be delayed until the initiating party submits complete information.

4. Within 75 days of receipt of the initial written communication, the Executive Director may convene a workshop to gather additional information from the initiating party, the Registration Provider and interested parties. All parties will have 15 days after the workshop to submit additional information regarding the alleged program errors.

5. Within 90 days after the Executive Director receives the application or within 30 days after receipt of complete additional information requested of the initiating party, whichever is later, the Executive Director shall either:

(a) Determine that the Data Registry need not be deactivated; or

(b) Submit to the Commission a written recommendation that the Data Registry be deactivated.

6. If the Commission approves the Data Registry deactivation, it shall take effect 60 days later. During the first 30 days of the 60 day period, the Executive Director shall send out a Notice to Enforcement Agencies and Interested Parties announcing the deactivation.

JA7.8.4.3 Burden of Proof

All initiating parties have the burden of proof to establish that the review of alleged Data Registry errors should be granted. The deactivation process may be terminated at any time by mutual written consent of the initiating party and the Executive Director.

The Registration Provider may use the 180 to 210-day period outlined here to update the Data Registry, get it re-approved by the Commission, and make available for use by authorized users, the revised version of the data registry that does not contain the errors initially brought to the attention of the Commission.

JA7.8.5 Data Registry User Manual

Each Registration Provider is required to publish a Data Registry User Manual. This requirement may be met with help screens incorporated into the Data Registry user interface, however, a printed version which includes all help screen items must be submitted with the application. The Data Registry User Manual provides guidance for building permit applicants and enforcement agency officials to enable correct use of the Data Registry, and assists with preparation of registered documentation used for submittals to enforcement agencies and other parties to the construction project.

The Document Registration Manual shall describe the specific Data Registry procedures for completing registered compliance documents. The manual shall provide instructions for preparing the data input and utilizing the registered documents for submittals. An example of a full set of compliance documents for a building project shall be included.

Data Registry User Manuals shall be written in a clear and concise manner and with an organization and format that will allow users to quickly locate the topic and understand the instructions. Also, Registration Providers

shall make electronic copies of their user manual available from their Data Registry web-site to all building departments in California.

The following sections describe the information that shall be included in all compliance supplements. It also presents the required organization for that information.

JA7.8.5.1 Energy Commission Approval

This section includes a copy of the official Energy Commission notice of approval of the Data Registry. It shall include the date of approval, and may include an expiration date for approval as well. The Energy Commission will provide this notice upon completion of evaluation and approval of the Data Registry service.

JA7.8.5.2 Data Registry Capabilities

This section shall discuss the Data Registry capabilities, providing explanation of how to access these capabilities, and the purpose for each of these features. Reference may be made to sections of the Data Registry Users Manual for more complete description.

JA7.8.5.3 Preparing Basic Documents

This section shall cover the basic use of the Data Registries to prepare each of the basic Compliance Document types. Reference may be made to the users' manual, but this section should include a complete summary of all document creation methods or commands necessary to complete the required registered documents.

JA7.8.5.4 Instruction for Submittal of the Registered Document(s)

This section shall contain instruction for completing submittals of completed registered documents to enforcement agencies or other persons who require copies of completed registered documents. Instruction shall be given for all methods of submittal the Data registry supports, including various methods for submittal of electronic copies of the registered documents, as well as for printing of paper copies

JA7.8.5.5 Sample Compliance Documentation

This section shall include an example of a complete set of compliance documentation for a sample building. The building need not be overly complex, nor need it include every document type possible. The example should, however, include example documentation for all Compliance document types that would normally be submitted for any occupancy types administered by the Data Registry.

JA7.9 Approval of Software Used for Data Input to Data Registries

This section explains the requirements for approval of software used for data input to data registries for creating and registering documents required for compliance with Part 6.

The Commission shall perform acceptance testing of software when a software vendor applicant submits an application in order to determine if the applicable requirements in Reference Joint Appendix JA7 have been met.

Detailed guidance for approval of software may be provided in the Data Registry Requirements Manual.

Note: JA7.9 does not apply to approval of compliance software used for the performance method for demonstrating compliance with Part 6.

JA7.9.1 Overview

The approval procedure requires self-testing and self-certification by the software vendor applicant. The software vendor applicant shall conduct the specified tests, evaluate the results and certify in writing that the software passes the tests. The Commission shall perform spot checks and may require additional tests to verify that the proposed software is suitable for use for providing the data input for completion of the compliance documents as required by the Standards. The software vendor shall develop a user manual or online help screens that explain how to perform the data input procedures offered by the software. The user manual or online help screens shall be reviewed by the Commission for accuracy and ease of use.

JA7.9.2 Application Checklist

The following is a list of the items that shall be included in an application package for software certification by the Commission:

JA7.9.2.1 Software Vendor Applicant Certification Statement.

A statement from the software vendor applicant certifying the reliability and accuracy of the software when used for data input to Data Registries for creating and registering compliance documents in accordance with the requirements of Reference Joint Appendix JA7, and may reference the guidance given in the Data Registry Requirements Manual.

The template for the Software Vendor Certification Statement document may be published in the Data Registry Requirements Manual, and electronic versions of the Software Vendor Certification Statement template shall be made available to Software Vendor applicant upon request.

JA7.9.2.2 Compliance Document Registration Test Results.

Electronic copies of the results of the data exchange verification tests, and electronic copies of the registered documents that result from the compliance report generator tests shall be provided.

Detailed guidance to assist the applicant in performing and reporting the standardized tests may be given in the Data Registry Requirements Manual.

JA7.9.2.3 User Manual

A copy of the user manual for the software shall be provided in an electronic format that can be utilized by word processing software. Help screens from the software user interface, organized into an electronic document file with a table of contents is an acceptable alternative to the requirement for a user manual.

JA7.9.2.4 Application Fee and Other Administrative Requirements

Refer to Standards Section 10-109(i)1 for required application fees and additional administrative requirements applicable to approval of software used with data registries.

JA7.9.3 Types of Approval

There are two software approval procedures: full approval, and amendment to full approval. Full approval is required for all software changes unless they qualify for the amendment to full approval procedure.

JA7.9.3.1 Full Approval

Full approval is required when an applicant software service has not previously been approved by the Commission. Additionally, the Commission may require that all approved data input software tools conform to the requirements of a full approval procedure when the Standards are updated (re-approval), or whenever substantial changes are made to a software's functionality, security, or technology features. When software re-

approval is mandated by the Commission, all software vendors shall be notified of the re-approval timetable. A revised Data Registry Requirements Manual may be published to provide guidance for the re-approval process.

Full approval shall ensure the software conforms to all applicable requirements for functionality and security in JA7 including but not limited to:

- Document data validation (JA7.6.3.2.2)
- Capability for data exchange with compliance report generation services approved by the Commission to generate formatted electronic documents (JA7.7),

Detailed guidance to assist with approval procedures may be given in the Data Registry Requirements Manual.

JA7.9.3.2 Amendments

Certain types of changes to software applications may be made through a streamlined amendment process. Changes that qualify for amendment approval are changes for which there are minor changes to the document registration procedures, data input requirements, or documentation output for the software. When software modifications qualify for amendment approval, the following procedure shall be followed:

1. The software vendor applicant shall notify the Commission in writing to provide a description of the change and the reason for making the change.
2. The software vendor applicant shall prepare an addendum to the user manual describing the change to the software if applicable.
3. The Commission shall respond to the software vendor applicant within 45 days. The Commission response to the applicant may:
 - approve the modification;
 - request additional information;
 - refuse to approve the modification;
 - require the software vendor to submit results of additional acceptance tests applicable to the modification;
or
 - require that the software vendor make specific changes to either the User Manual addendum or the software functionality.

The software vendor shall submit results of any required validation tests applicable to the modification. It is not necessary to resubmit software test results previously submitted that remain valid.

Any amendment to an existing software approval shall be accompanied by a cover letter explaining the type of amendment requested, and copies of any other applicable documents that are required. All items on the application checklist shall be submitted, when applicable. The timetable for approval of amendments is the same as for full approval.

4. With Commission approval, the software vendor may make the modified software available for use for registration of compliance documentation, along with the modified user manual or addendum to the user manual, and shall notify authorized users of the software.

JA7.9.4 Rescinding Approval (Deactivation) of Software

The Commission may rescind approval of software through various means.

JA7.9.4.1 Procedures that Initiate Deactivation

1. All software is deactivated when the Standards undergo substantial changes, usually occurring with each Standards update. However, the software shall remain approved to provide data input to Data Registries for creating and registering compliance documents for projects that have been permitted under the prior versions of the Standards.

2. Any software can be deactivated by a letter from the software vendor requesting that the software be deactivated. The deactivation request shall briefly describe the reasons that justify the need for deactivation.

3. Any "initiating party" may commence a procedure to deactivate a software tool according to the steps outlined below. The intent is to provide a means whereby serious software errors, flawed numeric results, improper document output not discovered in the software approval process can be verified, and a corrective course of action determined. In this process, there is ample opportunity for the Commission, the software vendor, and all interested parties to evaluate any alleged errors in the software functionality.

JA7.9.4.2 Challenging a Software Tool and Initiating Deactivation

A description of the process for challenging a software tool or initiating a deactivation procedure follows:

1. Any party may initiate a review of a software tool approval by sending a written communication to the Commission's Executive Director. (The Commission may be the initiating party for this type of review by noticing the availability of the same information listed here.) The initiating party shall:

(a) State the name of the software that contains the alleged errors;

(b) Identify concisely the nature of the alleged errors in the software that require review;

(c) Explain why the alleged errors are serious enough in their effect on document registration compliance to justify a deactivation procedure; and

(d) Include appropriate data electronically (in a format agreed to by the Commission staff) and/or information sufficient to evaluate the alleged errors.

2. The Executive Director shall make a copy or copies of the initial written communication available to the software vendor and interested parties within 30 days. Comments from interested parties shall be received within 60 days of the acceptance of the original application.

3. Within 75 days of receipt of the written communication, the Executive Director may request any additional information needed to evaluate the alleged software errors from the party who initiated the deactivation review process. If the additional information is incomplete, this procedure will be delayed until the initiating party submits complete information.

4. Within 75 days of receipt of the initial written communication, the Executive Director may convene a workshop to gather additional information from the initiating party, the software vendor and interested parties. All parties will have 15 days after the workshop to submit additional information regarding the alleged program errors.

5. Within 90 days after the Executive Director receives the application or within 30 days after receipt of complete additional information requested of the initiating party, whichever is later, the Executive Director shall either:

(a) Determine that the software need not be deactivated; or

(b) Submit to the Commission a written recommendation that the software be deactivated.

6. If the Commission approves the software deactivation, it shall take effect 60 days later. During the first 30 days of the 60 day period, the Executive Director shall send out a Notice to Data Registries, Enforcement Agencies, and other Interested Parties announcing the deactivation.

JA7.9.4.3 Burden of Proof

All initiating parties have the burden of proof to establish that the review of alleged software errors should be granted. The deactivation process may be terminated at any time by mutual written consent of the initiating party and the Executive Director.

The software vendor may use the 180 to 210-day period outlined here to update the software, get it re-approved by the Commission, and make available for use by authorized users, the revised version of the software that does not contain the errors initially brought to the attention of the Commission.

JA7.9.5 Software User Manual

Each software vendor is required to publish a Software User Manual. This requirement may be met with help screens incorporated into the software user interface, however, a printed version which includes all help screen items must be submitted with the application. The Software User Manual provides guidance for building permit applicants and enforcement agency officials to enable correct use of the software, and assists with preparation of registered documentation used for submittals to enforcement agencies and other parties to the construction project.

The Software User Manual shall describe the specific software procedures for completing compliance documents for use for registration. The manual shall provide instructions for preparing the data input and utilizing the completed formatted documents for registration.

Software User Manuals shall be written in a clear and concise manner and with an organization and format that will allow users to quickly locate the topic and understand the instructions. Also, software vendor shall make electronic copies of their user manual available from their Software product website to all building departments in California.

The following sections describe the information that shall be included in all compliance supplements. It also presents the required organization for that information.

JA7.9.5.1 Energy Commission Approval

This section includes a copy of the official Energy Commission notice of approval of the software tool. It shall include the date of approval, and may include an expiration date for approval as well. The Energy Commission will provide this notice upon completion of evaluation and approval of the software tool.

JA7.9.5.2 Software Capabilities

This section shall discuss the software capabilities, providing explanation of how to access these capabilities, and the purpose for each of these features.

JA7.9.5.3 Preparing Basic Documents

This section shall cover the basic use of the software to prepare each of the applicable Compliance Document types. Reference may be made to the users' manual, but this section should include a complete summary of all document creation methods or commands necessary to complete the required compliance documents.

JA7.9.5.4 Sample Compliance Documentation

This section shall include an example of the applicable compliance documentation for a sample building. The building need not be overly complex, but the example should, however, include example documentation for all Compliance document types that would normally be submitted for any occupancy types administered by the Data Registry.

JA7.10 Related Publications

The Compliance Supplement should refer users to the following related Energy Commission publications and where to obtain them:

- 2013 Building Energy Efficiency Standards (publication number unknown at time of printing)

- [2013 Joint Appendices](#)
- [2013 ACM Approval Manual](#)
- [2013 Residential Compliance Manual \(publication number unknown at time of printing\)](#)
- [2013 Nonresidential Compliance Manual \(publication number unknown at time of printing\)](#)
- [2013 Data Registry Requirements Manual](#)
- [2013 ACM Reference Manual](#)

These publications are available from:

[California Energy Commission](#)
[Publications Unit](#)
[1516 Ninth Street](#)
[Sacramento CA 95814](#)
[\(916\) 654-5200](#)

Joint Appendix JA8

Appendix JA8 – Testing of Light Emitting Diode Light Sources Qualification Requirements for Residential Luminaires Using LED Light Source

JA4.3 Scope

The testing methods in this appendix shall be used to determine wattage, luminous flux, and efficacy for all light emitting diode (LED) Luminaires, and LED Light Engines with Integral Heat Sink. Each device tested shall produce the same quantity and quality of light. LED Luminaires or LED Light Engines with Integral Heat Sink producing different Correlated Color Temperature (CCT), Color Rendering Index (CRI), total flux (per linear foot for linear systems) or other quantitative and qualitative differences in light shall be separately tested.

The power (wattage) of luminaires and integral trims containing only LED light sources shall be determined in accordance with JA8. 2. For luminaires containing LED light sources in addition to one or more other lighting technologies (i.e., Hybrid LED Luminaires), the power of the LED Light Engines with Integral Heat Sink shall be determined in accordance with JA8. 2, and the power of non-LED lighting components shall be determined in accordance with Title 24, Part 6, §130(d)(1, 2, 3, 4, or 6) as appropriate.

The light output (luminous flux) of the luminaires and integral trims containing only LED light sources shall be determined in accordance with JA 8.3. For luminaires containing LED light source in addition to one or more other lighting technologies (i.e., Hybrid LED Luminaires), the light output of the LED Light Engine with Integral Heat Sink shall be determined in accordance with JA8.3.

The efficacy of luminaires and integral trims containing only LED light sources shall be determined in accordance with JA8. 4. For luminaires containing LED Light Engines with Integral Heat Sink in addition to one or more other lighting technologies, the efficacy of the LED Light Engines with Integral Heat Sink shall be determined in accordance with JA8. 4, and the efficacy of non-LED lighting components shall be determined in accordance with Title 24, Part 6, §150(k)1 and 2.

JA4.4 Determining the Wattage of Light Emitting Diode (LED) Luminaires or LED Light Engine with Integral Heat Sink

The wattage of LED Luminaire or LED Light Engines with Integral Heat Sink shall be measured as follows, or by a method approved by the Executive Director:

- a. The wattage shall be the maximum rated input wattage of the device under test, including power used by fans, transformers and power supply devices, and
- b. The wattage shall be listed on a permanent, pre-printed, factory-installed label on the luminaire housing, or on the integral LED trim when applicable, and
- c. The device under test shall be tested in a Underwriters Laboratory (UL) 1598 testing apparatus in a testing laboratory accredited to ISO/IEC 17025 by the National Voluntary Laboratory Accreditation Program (NVLAP) or other laboratory accreditation body operating in accordance with ISO/IEC 17011 and produced under an ongoing inspection program carried out by a Type A inspection body in accordance with ISO/IEC 17020, accredited to ISO/IEC 17020 by an accreditation body operating in accordance with ISO/IEC 17011; and
- d. The device under test shall be tested according to all of the following conditions:

The ambient temperature in which measurements are being taken shall be maintained at $25^{\circ}\text{C} \pm 1^{\circ}\text{C}$.

The AC power supply shall have a frequency of 60 Hz, and a sinusoidal voltage wave shape.

The voltage of an AC or DC power supply shall be regulated to within ± 0.2 percent.

The device under test shall be burned in for 100 hours before testing.

The device under test shall be operated and stabilized before testing at ambient temperature and burning position as specified until the LED product reaches thermal equilibrium. Stability is reached when the variation of light output remains within 1 percent for a period of 10 minutes at constant ambient temperature and constant electrical input.

The device under test shall be measured at the burning position in which it will be installed in the luminaire.

The device under test shall be operated at the rated voltage (AC or DC) according to the specification of the LED luminaires or LED Light Engines with Integral Heat Sink for its normal use.

Testing using pulsed operation of the LED luminaires or LED light engines with integral heat sink shall not be acceptable

~~JA4.5 Luminous Flux Measurement of LED Luminaires or LED Light Engine with Integral Heat Sink~~

The Luminous flux of the LED luminaire or LED Light Engines with Integral Heat Sink shall be measured as follows, or by a method approved by the Executive Director:

- a. Luminous flux shall be measured after the device under test has stabilized in accordance with JA 8.2;
- b. The total luminous flux of the device under test shall be measured with an integrating sphere photometer or a goniophotometer by a lab accredited by Underwriters Laboratory (UL) under their Data Acceptance Program (DAP); and
- c. The total luminous flux of the device under test shall be permanently pre-printed on the LED circuit board, on a permanent pre-printed factory installed label on an integral LED trim or luminaire housing, or published in manufacturer's catalogs based on independent testing lab reports.

~~JA4.6 Efficacy Calculation of LED Luminaires or LED Light Engine with Integral Heat Sink~~

The efficacy of LED Luminaire or LED Light Engine with Integral Heat Sink shall be determined as follows, or by a method approved by the Executive Director:

- a. The efficacy of the device under test shall be the quotient of measured total luminous flux (lumens) of the device under test when tested in accordance with JA8.3 and the measured electrical input power (watts) of device under test when tested in accordance with JA8.2; and

The efficacy of the installed luminaire can be assumed to be equal to the device under test.

To qualify as a residential high efficacy luminaire using Light Emitting Diode (LED) as the light source (as defined in IES LM-80-2008), the LED light engine (as defined in ANSI/IES RP-16-2010) used in the luminaire shall be certified to the Energy Commission according to all of the following requirements, or by a method approved by the Executive Director. If the LED light engine is inseparable from the luminaire (integral LED luminaire) then the entire luminaire shall meet the same requirements. LED light engine(s) and integral LED luminaire(s) are referred to as LED luminaire(s) below.

- a. Shall be manufactured for use in residential applications. LED luminaires not intended for use in residential applications, LED landscape luminaires, and luminaire housings not containing a light engine shall not be certified to the Energy Commission for the purpose of complying with Joint Appendix JA-8.
- b. The efficacy of the integral LED luminaire or LED light engine, when tested in accordance with IES LM-79-2008, shall be equal to or greater than the efficacies contained in TABLE JA-8.

c. When designed or rated for indoor use shall be capable of providing a nominal Correlated Color Temperature (CCT) that includes at least one point within the range of 2700K to 4000K; when designed or rated for outdoor use shall be capable of providing a nominal CCT that includes at least one point within the range of 2700K to 5000K; with tolerance defined as in ANSI C78-377-2008.

Exception to Section (c): Monochromatic LEDs that are only for decorative purposes

d. Shall be capable of providing a minimum Color Rendering Index (CRI) of 90.

Exception to Section (d): Monochromatic LEDs that are only for decorative purposes

e. An LED light engine shall be capable of being installed in luminaire housing without using any type of base or socket used for incandescent lamps; it may include a GU-24 or modular quick connect, but shall not include screw base sockets or adaptors of type and size E12 through E39.

f. An LED lamp, integrated or non-integrated type in accordance with the definition in ANSI/IES RP-16-2010, shall not be certified to the Energy Commission as a high efficacy luminaire or high efficacy light engine, and shall not be classified as a high efficacy luminaire for compliance with Title 24, Part 6 of the CCR.

g. The integral LED luminaire or LED light engine under test shall be tested in a Underwriters Laboratory (UL) 1598 testing apparatus in a testing laboratory participating in the ISO/IEC 17025, by the National Voluntary Laboratory Accreditation Program (NVLAP) or other laboratory accreditation body operating in accordance with ISO/IEC 17011 and produced under an ongoing inspection program carried out by a Type A inspection body in accordance with ISO/IEC 17020, accredited to ISO/IEC 17020 by an accreditation body operating in accordance with ISO/IEC 17011.

h. Each integral LED luminaire or LED light engine tested shall produce the same quantity and quality of light. An integral LED luminaire or LED light engine under test producing different Correlated Color Temperature (CCT), Color Rendering Index (CRI), total flux (per linear foot for linear systems) or other quantitative and qualitative differences in light shall be separately tested and separately certified to the Energy Commission.

i. A worst case test may be used to certify a group of integral LED luminaires or LED light engines having the same quantity and quality of light in accordance with section (h).

j. For determining efficacy, the input wattage of the integral LED luminaire or LED light engine under test shall be determined as follows:

1. For single LED luminaires, use the maximum rated input wattage of the luminaire.

2. When multiple LED light engines are connected to a single power supply, all possible combinations shall be tested to determine the various input wattages and efficacies for the power supply under test. The combination providing the worst case efficacy shall be the system efficacy.

3. LED luminaires, installed on lighting track that is capable of being used with multiple lighting technologies, shall be treated as single LED luminaires in accordance with section (j)1. Lighting track capable of accommodating any non-LED lighting technologies shall not be certified as LED lighting.

k. For single LED luminaires, maximum rated input wattage, total luminous flux, CCT, and CRI of the integral LED luminaire or LED light engine under test shall be listed on a permanent, pre-printed, factory-installed label on the circuit board, light engine, or luminaire housing.

l. For LED systems in accordance with section (j)2, all possible wattage combinations, luminous flux, CCT, CRI, and efficacies of each of possible combination of the integral LED luminaire or LED light engine under test shall be listed on a permanent, pre-printed, factory-installed label on the power supply, or published in manufacturer's catalogs.

TABLE JA-8 HIGH EFFICACY QUALIFICATION REQUIREMENTS FOR LUMINAIRES OR LIGHT ENGINES USING LED LIGHT SOURCES

<u>Power Rating per Integral LED Luminaire, or per LED Light Engine Under Test</u>	<u>Minimum Efficacy (Lumens Per Watt)</u>
<u>5 watts or less</u>	<u>30</u>
<u>over 5 watts to 15 watts</u>	<u>45</u>
<u>over 15 watts to 40 watts</u>	<u>60</u>
<u>over 40 watts</u>	<u>90</u>

Joint Appendix JA9

Appendix JA9 – Qualification Requirements for Low Leakage Air-Handling Units

JA9.1 Purpose and Scope

Joint Appendix JA9 provides the air leakage qualification requirements for air-handling units intended for installation in ducted forced-air space conditioning systems, that are rated by the manufacturer to move less than 3,000 cfm (1400 L/s) of air.

Air-handling unit equipment types include:

- furnaces
- heat pumps
- air conditioners

Joint Appendix JA9 does not apply to coil boxes, filter boxes, or other duct system components that are not an integral part of the air-handling unit cabinet or enclosure certified by the manufacturer.

Joint Appendix JA9 does not apply to ducts, plenums, or other field-constructed components.

JA9.2 Qualification Requirements

To qualify as a low leakage air-handling unit for use for compliance with applicable performance compliance methods, the air-handling unit shall be certified to the Energy Commission according to the following requirements:

JA9.2.1 Method of Test

The air-handling unit shall be tested in accordance with the requirements given in ASHRAE Standard 193.

JA9.2.2 Testing Laboratory Requirements

The Air-Handling Unit shall be tested in a laboratory that has demonstrated compliance with ISO Standard 17025, General Criteria for the Competence of Testing and Calibration Laboratories, and is accredited for the ASHRAE Standard 193 test methods. The accrediting body shall be a signatory to the International Accreditation Forum Multilateral Recognition Agreement (IAF MLA). <http://www.iaf.nu/>

JA9.2.3 Nominal Air-Handling Unit Airflow

The nominal air-handling unit airflow used for determining the leakage criterion for qualification shall be as follows:

- For heating-only systems the nominal air-handling unit airflow shall be 21.7 cfm per kBtu/hr of rated heating output capacity.
- For systems that provide space cooling, the nominal air-handling unit airflow shall be 400 cfm per nominal ton of cooling capacity as specified by the manufacturer, or the heating-only value, whichever is greater.

JA9.2.4 Leakage Criterion for Qualification

Allowable leakage for qualification as a Low Leakage Air-Handling Unit shall be equal to or less than 1.4 percent of the nominal air-handling unit airflow as determined by Section JA9.2.3.

¹ Definitions taken from the 2006 ICB.