



County of San Diego, Planning & Development Services
2016 BUILDING ENERGY EFFICIENCY STANDARDS
BUILDING DIVISION

PROVISIONS APPLICABLE TO LOW-RISE RESIDENTIAL BUILDINGS

The *2016 Building Energy Efficiency Standards* for low-rise residential buildings – found in Title 24, Part 6, of the *California Code of Regulations* – became effective January 1, 2017, and apply to the following projects:

- All single-family dwellings of any number of stories (Group R-3 occupancy)
- All duplex (two-dwelling) buildings of any number of stories (Group R-3 occupancy)
- All multifamily buildings – not including hotels and motels – with three or fewer habitable stories (Group R-1 and R-2 occupancies)
- Additions and alterations to all of the above buildings

For additional information regarding the *2016 Building Energy Efficiency Standards* – including provisions applicable to nonresidential buildings – please visit <http://www.energy.ca.gov/title24> or call the California Energy Commission's Energy Efficiency Hotline at (800) 772-3300 or (916) 654-5106.

Mandatory compliance

All low-rise residential buildings shall meet the applicable mandatory provisions found in sections 110.0 through 110.10 and section 150.0 of the standards; these mandatory items include the lighting, indoor air quality, and Home Energy Rating System (HERS) rater verification provisions outlined on page 8 of this document.

Prescriptive and performance compliance

In addition to mandatory compliance, all projects shall satisfy one of the following compliance approaches:

- Prescriptive compliance:** The simplest compliance approach but also the least flexible. Each individual energy component of the proposed building shall meet a prescribed minimum efficiency standard based on the project location. **This document includes instructions for completing plan check documentation using the prescriptive compliance approach.**
- Performance compliance:** The most flexible compliance approach but also the most complex. This approach involves working with a private energy efficiency consultant to model the proposed building using computer software approved by the California Energy Commission. The software determines the building's allowable energy budget, then enables the consultant to modify the building's individual energy components to achieve compliance with the efficiency standards. **Under the performance compliance approach, the energy efficiency consultant will generate the applicable plan check documentation.**

Plan check documentation

The following energy efficiency compliance documents – available for download at <http://www.energy.ca.gov/2015publications/CEC-400-2015-032/appendices/forms/> – shall be submitted with the building plans at the time of permit application:

- CF1R, Certificates of Compliance.** One of the following certificates of compliance – applicable as indicated for the project scope – shall be completed, signed by the documentation author and project designer, and made a permanent part of the plans (**Note:** When HERS rater verification is required for compliance, **all applicable CF1R certificates shall be registered with a state-approved HERS provider data registry**, with the registered copies made a permanent part of the plans):
 - **CF1R-PRF-E:** Applies to all performance compliance submittals
 - **CF1R-NCB-01-E:** Applies to prescriptive compliance submittals for newly constructed buildings and additions of more than 1000 s.f.



County of San Diego, Planning & Development Services 2016 BUILDING ENERGY EFFICIENCY STANDARDS BUILDING DIVISION

- **CF1R-ADD-01-E:** Applies to prescriptive compliance submittals for additions of 1,000 square feet or less
- **CF1R-ADD-02-E:** May be used for prescriptive compliance submittals for additions of 300 square feet or less **and** not requiring HERS rater verification
- **CF1R-ALT-01-E:** Applies to prescriptive compliance submittals for alterations
- **CF1R-ALT-02-E:** Applies to HVAC change-outs

The following supplemental energy efficiency compliance documents may be required if applicable:

- CF1R-ENV-02-E:** Area-weighted average calculation worksheet
- CF1R-ENV-03-E:** Solar Heat Gain Coefficient (SHGC) worksheet
- CF1R-ENV-04-E:** Cool roof and Solar Reflectance Index (SRI) calculation worksheet
- CF1R-PLB-01-E:** Hydronic heating system worksheet
- CF1R-SRA-01-E:** Solar-ready areas
- CF1R-SRA-02-E:** Minimum solar zone area worksheet
- CF1R-STH-01-E:** OG 300 solar water heating system worksheet
- CF1R-STH-02-E:** OG 100 solar water heating system worksheet

Instructions for completing plan check documentation using the prescriptive compliance approach

- See Table A to determine the climate zone of the proposed project site. Beginning with the 2016 standards, ZIP code boundaries are used to define climate zone boundaries. For ZIP codes not listed in the table, the applicable climate zone may be determined using the following list: <http://www.energy.ca.gov/maps/renewable/BuildingClimateZonesByZIPCode.pdf>.
- See Table B – with subsequent references to Tables C, D, and E – to determine the minimum requirements for each building component based on the project climate zone.
- Complete the applicable CF1R certificate of compliance using the established minimum requirements determined per the step above and project-specific information, including proposed building orientation, conditioned floor area, construction assembly types, fenestration areas, space heating and cooling systems, and water heating systems.

Construction documentation

The following energy efficiency compliance documents – available for download at <http://www.energy.ca.gov/2015publications/CEC-400-2015-032/appendices/forms/> – shall be provided to the County of San Diego building inspector in the field during construction:

- CF2R, Certificates of Installation**, shall be completed and signed by the builder or general contractor responsible for installing regulated energy efficiency features. CF2R documents certify the installed features, materials, components, and/or manufactured devices conform to the low-rise residential standards and Title 20 Appliance Efficiency Regulations. **Note:** When HERS rater verification is required for compliance, **all applicable CF2R certificates shall be registered with a state-approved HERS provider data registry**, with the registered copies provided to the building inspector in the field.
- CF3R, Certificates of Verification**, shall be completed and signed/certified by a third-party HERS rater when field verification or diagnostic testing is required for compliance. Third-party HERS rater verification is **mandatory** – regardless of the compliance option selected – for **all newly constructed residential buildings** and many residential additions and alterations. **Note:** When HERS rater verification is required for compliance, **all applicable CF3R certificates shall be registered with a state-approved HERS provider data registry**, with the registered copies provided to the building inspector in the field.

TABLE A: CLIMATE ZONES

ZIP CODE	COMMUNITY	CLIMATE ZONE
91901	Alpine	10
91902	Bonita	7
91905	Boulevard	14
91906	Campo	14
91910	Bonita	7
91916	Descanso	14
91917	Dulzura	10
91931	Guatay	14
91934	Jacumba	14
91935	Jamul	10
91941	Mount Helix	7
91945	Lemon Grove	7
91948	Mount Laguna	14
91950	Lincoln Acres	7
91962	Pine Valley	14
91963	Potrero	14
91977	Spring Valley	10
91978	Spring Valley	10
91980	Tecate	14
92003	Bonsall	10
92004	Borrego Springs	15
92014	Rancho Santa Fe	7
92019	El Cajon	10
92020	El Cajon	10
92021	El Cajon	10
92024	San Marcos	7
92025	Escondido	10
92026	Escondido	10
92027	Escondido	10
92028	Fallbrook	10
92029	Escondido	10
92036	Julian	14
92040	Lakeside	10
92059	Pala	10
92060	Palomar Mountain	14
92061	Pauma Valley	10
92064	Poway	10
92065	Ramona	10
92066	Ranchita	14
92067	Rancho Santa Fe	7
92069	San Marcos	10
92070	Santa Ysabel	14
92071	Santee	10
92078	San Marcos	10
92081	Vista	7
92082	Valley Center	10
92083	Vista	7
92084	Vista	7
92086	Warner Springs	14
92091	Rancho Santa Fe	7
92127	Rancho Bernardo	10
92154	Otay	7
92259	Ocotillo	15

TABLE B: PRESCRIPTIVE COMPLIANCE PACKAGES^{1,2,3}

COMPONENT	CLIMATE ZONE 7	CLIMATE ZONE 10	CLIMATE ZONE 14	CLIMATE ZONE 15
Building envelope				
Roof/ceiling insulation (minimum):				
Option A ⁴	R-30	R-38+R-8/R-6	R-38+R-8/R-6	R-38+R-8/R-6
Option B ⁵	R-30	R-38+R-18/R-13	R-38+R-18/R-13	R-38+R-18/R-13
Option C ⁶	R-30	R-30	R-38	R-38
Wall insulation (minimum)				
2 x 4 wood studs @ 16" on center ⁷	R-13+R-5	R-13+R-10	R-13+R-10	R-13+R-10
2 x 6 wood studs @ 16" on center ⁷	R-19+R-2	R-19+R-5	R-19+R-5	R-19+R-5
Raised floor insulation (minimum)	R-19	R-19	R-19	R-19
Radiant barrier	REQ	REQ ⁸	REQ ⁸	REQ ⁸
Low-sloped (≤ 2:12) roofing (minimum) ⁹ :				
Thermal emittance/aged solar reflectance	NR/NR	NR/NR	NR/NR	0.75/0.63
Steep-sloped (> 2:12) roofing (minimum) ⁹ :				
Thermal emittance/aged solar reflectance	NR/NR	0.75/0.20	0.75/0.20	0.75/0.20
Fenestration				
U-factor (maximum) ¹⁰	0.32	0.32	0.32	0.32
SHGC (maximum) ¹¹	0.25	0.25	0.25	0.25
Total fenestration area (maximum) ¹²	20%	20%	20%	20%
West-facing fenestration area (maximum) ¹²	5%	5%	5%	5%
Space heating¹³ See Table C for MIN values				
Electric-resistance allowed	NO	NO	NO	NO
AFUE (gas)	MIN	MIN	MIN	MIN
HSPF (heat pump)	MIN	MIN	MIN	MIN
Space cooling See Table D for MIN values				
SEER / EER	MIN	MIN	MIN	MIN
Refrigerant charge HERS rater verification	NR	REQ	REQ	REQ
Whole-house fan ¹⁴	NR	REQ	REQ	REQ
Ducts				
Duct insulation (minimum)				
Roof/ceiling insulation options A and B	R-6	R-8	R-8	R-8
Roof/ceiling insulation option C	R-6	R-6	R-6	R-6
Water heating See Table E for allowable options and MIN values				
Energy Factor	MIN	MIN	MIN	MIN

LEGEND: NR = Not Required, REQ = Required, MIN = Shall meet minimum

TABLE B FOOTNOTES:

- In addition to prescriptive measures, project shall meet all applicable mandatory requirements in §110.0 - §110.10 and §150.0.
- See §150.1 for limited exceptions applicable to newly constructed low-rise residential buildings.
- See §150.2 for limited exceptions applicable to additions and alterations to low-rise residential buildings.
- Option A requires ceiling insulation between attic and conditioned space **and** – except for climate zone 7 – continuous insulation above roof rafters and in contact with roof deck. “R-38+R-8/R-6” means R-38 ceiling insulation plus R-8 continuous insulation (if no air space present between roofing and roof deck) or R-6 continuous insulation (if air space present between roofing and roof deck).
- Option B requires ceiling insulation between attic and conditioned space **and** – except for climate zone 7 – insulation between roof rafters and in contact with roof deck. “R-38+R-18/R-13” means R-38 ceiling insulation plus R-18 insulation between roof rafters (if no air space present between roofing and roof deck) or R-13 insulation between roof rafters (if air space present between roofing and roof deck).
- Option C requires all space conditioning equipment and ducts to be located in conditioned space and confirmed by HERS verification.
- Requires combination of cavity and continuous insulation. “R-19+R-5” means R-19 cavity insulation plus R-5 continuous insulation.
- Radiant barrier not required if roof/ceiling insulation complies with Option B as tabulated.
- Roofing products shall be listed in the Cool Roof Rating Council’s Rated Products Directory (<http://www.coolroofs.org>).
- The installed fenestration products shall meet the requirements of §150.1(c)3.
- The installed fenestration products shall meet the requirements of §150.1(c)4.
- Fenestration area shall not exceed tabulated percentage of conditioned floor area.
- A supplemental heating unit may be installed in a space served directly or indirectly by a primary heating system, provided the unit thermal capacity does not exceed 2 kilowatts or 7,000 Btu/hr and is controlled by a time-limiting device not exceeding 30 minutes.
- Whole-house fan(s) shall provide total airflow of minimum 1.5 cfm per square foot of conditioned floor area per §150.1(c)12. Whole-house fans(s) shall be listed in California Appliance Efficiency Directory.

**TABLE C: SPACE-HEATING EQUIPMENT
MINIMUM EFFICIENCY REQUIREMENTS¹**

MINIMUM HEATING EFFICIENCY FOR GAS-FIRED CENTRAL FURNACES			
Type	Capacity	AFUE	Thermal Efficiency
Gas-fired central furnace (single phase)	< 225,000 Btu/hr	81%	NA
Gas-fired central furnace	≥ 225,000 Btu/hr	NA	80%
MINIMUM HEATING EFFICIENCY FOR BOILERS			
Type	Capacity	AFUE	Combustion Efficiency
Gas steam boilers (single phase)	< 300,000 Btu/hr	80%	NA
Gas hot water boilers (single phase)	< 300,000 Btu/hr	82%	NA
MINIMUM HEATING EFFICIENCY FOR NON-DUCTED, NON-CENTRAL GAS-FIRED HEATING EQUIPMENT			
Type	Capacity	AFUE	
Wall furnace (fan type)	≤ 42,000 Btu/hr	75%	
	> 42,000 Btu/hr	76%	
Wall furnace (gravity type)	≤ 27,000 Btu/hr	65%	
	> 27,000 Btu/hr and ≤ 46,000 Btu/hr	66%	
	> 46,000 Btu/hr	67%	
Floor furnace	≤ 37,000 Btu/hr	57%	
	> 37,000 Btu/hr	58%	
Room heater	≤ 20,000 Btu/hr	61%	
	> 20,000 Btu/hr and ≤ 27,000 Btu/hr	66%	
	> 27,000 Btu/hr and ≤ 46,000 Btu/hr	67%	
	> 46,000 Btu/hr	68%	
MINIMUM HEATING EFFICIENCY FOR HEAT PUMPS			
Type	Configuration / Size	Efficiency	
Packaged terminal heat pumps (heating mode)	Newly constructed or newly conditioned buildings or additions	3.7 - (0.052 x Cooling Capacity / 1000) = COP	
Packaged terminal heat pumps (heating mode)	Replacements	2.9 - (0.026 x Cooling Capacity / 1000) = COP	
Air-source heat pump (single phase)	< 65,000 Btu/hr Cooling Capacity (packaged)	8.0 HSPF	
	< 65,000 Btu/hr Cooling Capacity (split)	8.2 HSPF	
	Space-constrained < 65,000 Btu/hr Cooling Capacity (packaged)	7.4 HSPF	
	Space-constrained < 65,000 Btu/hr Cooling Capacity (split)	7.4 HSPF	
	Small duct high velocity < 65,000 Btu/hr Cooling Capacity	7.7 HSPF	
Air-source heat pump (three phase)	< 65,000 Btu/hr (packaged)	7.7 HSPF	
	< 65,000 Btu/hr (split)	7.7 HSPF	
Water-source heat pumps	< 135,000 Btu/hr	4.2 COP	
Vertical heat pumps (single package)	< 65,000 Btu/hr (single phase)	3.0 COP	
	< 65,000 Btu/hr (three phase)	3.0 COP	

TABLE C FOOTNOTE:

- For minimum efficiencies of other space-heating equipment, see Tables 4-1, 4-2, 4-3, and 4-4 in the Building Energy Efficiency Standards Residential Compliance Manual (http://www.energy.ca.gov/2015publications/CEC-400-2015-032/chapters/chapter_4-Building_HVAC_Requirements.pdf).

**TABLE D: SPACE-COOLING EQUIPMENT
MINIMUM EFFICIENCY REQUIREMENTS¹**

MINIMUM COOLING EFFICIENCY FOR CENTRAL AIR CONDITIONERS AND HEAT PUMPS			
Type	Output Capacity	SEER	EER
Central air conditioners (split)	< 45,000 Btu/hr	14.0	12.2
	≥ 45,000 Btu/hr and < 65,000 Btu/hr	14.0	11.7
Central air conditioners (single package)	< 65,000 Btu/hr	14.0	11.0
Central air source heat pump (split)	< 65,000 Btu/hr	14.0	NA
Central air source heat pump (single package)	< 65,000 Btu/hr	14.0	NA
Space-constrained air conditioner (split)	< 65,000 Btu/hr	12.0	NA
Space-constrained air conditioner (single package)	< 65,000 Btu/hr	12.0	NA
Space-constrained heat pump (split)	< 65,000 Btu/hr	12.0	NA
Space-constrained heat pump (single package)	< 65,000 Btu/hr	12.0	NA
Small duct, high velocity air conditioner	< 65,000 Btu/hr	12.0	NA
Small duct, high velocity heat pump	< 65,000 Btu/hr	12.0	NA
MINIMUM COOLING EFFICIENCY FOR NON-CENTRAL SPACE COOLING EQUIPMENT			
Type	Size Category (input)	EER	
Room air conditioner with louvered sides	< 6,000 Btu/hr	11.0	
	≥ 6,000 Btu/hr and < 8,000 Btu/hr	11.0	
	≥ 8,000 Btu/hr and < 14,000 Btu/hr	10.9	
	≥ 14,000 Btu/hr and < 20,000 Btu/hr	10.7	
	≥ 20,000 Btu/hr and < 28,000 Btu/hr	9.4	
	≥ 28,000 Btu/hr	9.0	
Room air conditioner without louvered sides	< 6,000 Btu/hr	10.0	
	≥ 6,000 Btu/hr and < 8,000 Btu/hr	10.0	
	≥ 8,000 Btu/hr and < 11,000 Btu/hr	9.6	
	≥ 11,000 Btu/hr and < 14,000 Btu/hr	9.5	
	≥ 14,000 Btu/hr and < 20,000 Btu/hr	9.3	
	≥ 20,000 Btu/hr	9.4	
Room air conditioner heat pump with louvered sides	< 20,000 Btu/hr	9.8	
	≥ 20,000 Btu/hr	9.3	
Room air conditioner heat pump without louvered sides	< 14,000 Btu/hr	9.3	
	≥ 14,000 Btu/hr	8.7	
Casement-only room air conditioner	All capacities	9.5	
Casement-slider room air conditioner	All capacities	10.4	
Package terminal air conditioner in newly constructed or newly conditioned building or addition (cooling mode)	All capacities	14.0 - (0.300 x Cooling Capacity / 1000) = EER	
Package terminal air conditioner replacement (cooling mode)	All capacities	10.9 - (0.213 x Cooling Capacity / 1000) = EER	
Package terminal heat pump in newly constructed or newly conditioned building or addition (cooling mode)	All capacities	14.0 - (0.300 x Cooling Capacity / 1000) = EER	
Package terminal heat pump replacement (cooling mode)	All capacities	10.8 - (0.213 x Cooling Capacity / 1000) = EER	
Vertical air conditioner (single package)	< 65,000 Btu/hr	10.0	
Vertical heat pump (single package)	< 65,000 Btu/hr	10.0	

TABLE D FOOTNOTE:

- For minimum efficiencies of other space-cooling equipment, see Tables 4-6, 4-7, and 4-8 in the Building Energy Efficiency Standards Residential Compliance Manual (http://www.energy.ca.gov/2015publications/CEC-400-2015-032/chapters/chapter_4-Building_HVAC_Requirements.pdf).

TABLE E: WATER HEATING MINIMUM REQUIREMENTS

PRESCRIPTIVE WATER HEATING OPTIONS FOR SINGLE DWELLING UNITS	
Option	Compliance criteria ¹
Single gas or propane instantaneous	<ul style="list-style-type: none"> ▫ Minimum Energy Factor per tabulated values below ▫ Gas input rating ≤ 200,000 Btu/hr
Single gas or propane storage (≤ 55 gallons)	<ul style="list-style-type: none"> ▫ Minimum Energy Factor per tabulated values below ▫ Gas input rating ≤ 105,000 Btu/hr ▫ HERS rater verification required to confirm dwelling unit meets all Quality Insulation Installation (QII) requirements ▫ HERS rater verification required to confirm installation of compact hot water distribution system <u>or</u> proper insulation of all domestic hot water piping
Single gas or propane storage (> 55 gallons)	<ul style="list-style-type: none"> ▫ Minimum Energy Factor per tabulated values below ▫ Gas input rating ≤ 105,000 Btu/hr ▫ HERS rater verification required to confirm installation of compact hot water distribution system <u>or</u> proper insulation of all domestic hot water piping
MINIMUM ENERGY FACTOR – SMALL WATER HEATERS	
Type	Energy Factor
Gas storage (≥ 20 gallons and ≤ 55 gallons)	0.675 – (0.0015 * volume)
Gas storage (> 55 gallons and ≤ 100 gallons)	0.8012 – (0.00078 * volume)
Gas instantaneous (< 2 gallons)	0.82 – (0.00019 * volume)

TABLE E FOOTNOTE:

1. In addition to prescriptive measures, water heating systems shall meet all applicable mandatory requirements in §110.3, §150.0(j), and §150.0(n).
2. For minimum efficiencies of other water heaters, see Table 5-5 in the Building Energy Efficiency Standards Residential Compliance Manual (http://www.energy.ca.gov/2015publications/CEC-400-2015-032/chapters/chapter_5-Water_Heating_Requirements.pdf).

Mandatory lighting compliance

All low-rise residential buildings shall comply with the following lighting measures (see section 150.0(k) for limited exceptions):

- ❑ All luminaires shall be high-efficacy
- ❑ All LED luminaires and lamps shall be marked “JA8-2016” and listed in the California Energy Commission database at <https://cacertappliances.energy.ca.gov/Pages/ApplianceSearch.aspx>
- ❑ All recessed downlight and enclosed luminaires shall be marked “JA8-2016-E” and listed in the California Energy Commission database
- ❑ Recessed downlight luminaires in ceilings shall not be screw-based
- ❑ At least one luminaire in each bathrooms, laundry room, utility room, and garage shall be controlled by a vacancy sensor
- ❑ All luminaires – except in closets less than 70 s.f. and in hallways – requiring “JA8-2016” or “JA8-2016-E” marking shall be controlled by a dimmer or vacancy sensor
- ❑ Outdoor lighting permanently mounted to building shall be controlled by photocontrol and motion sensor or photocontrol and automatic time-switch control or astronomical time clock or energy management control system

Mandatory indoor air quality compliance

All newly constructed low-rise residential buildings and low-rise residential buildings with proposed additions of more than 1000 square feet shall comply with ASHRAE Standard 62.2-2010 indoor air quality measures – as adopted by the California Energy Commission – including the following:

- ❑ A mechanical exhaust ventilation system, supply ventilation system, or combination thereof shall be installed for each dwelling unit to provide whole-building ventilation with **outdoor air; HERS rater verification required** to confirm whole-building ventilation airflow.
- ❑ An intermittently or continuously operating local mechanical exhaust ventilation system shall be installed in each kitchen and in each bathroom with a bathtub, shower, or similar moisture source. Intermittent local exhaust ventilation airflow rates shall be 50 cfm in bathrooms and 100

cfm in kitchens. Continuous local exhaust ventilation airflow rates shall be 20 cfm in bathrooms and 5 air changes per hour in kitchens based on kitchen volume.

- Minimum MERV 6 filters for mechanical system ductwork supplying conditioned air
- Doors between garage and dwelling shall be gasketed or made substantially airtight with weather stripping.
- Clothes dryers shall be exhausted directly to the outdoors
- Combustion appliances shall be properly vented, and air systems shall be designed to prevent back-drafting.

Mandatory HERS rater verification

HERS rater verification is mandatory for the following elements in newly constructed low-rise residential buildings and proposed additions and alterations to low-rise residential buildings:

- Mechanical supply- and return-air duct sealing
 - Exception:** Not required in additions or alterations if existing space-conditioning system equipment remains **and** less than 40 feet of new or replacement ducts installed in unconditioned or indirectly conditioned space
 - Exception:** Not required in additions or alterations if new/replacement space-conditioning equipment **and** less than 40 feet of cumulative existing and new ducts in unconditioned spaces
- Cooling system airflow and air-handling unit fan efficacy
- Whole-building ventilation per the “Mandatory indoor air quality compliance” section of this document