Low-Rise Residential

What's New in 2019?

What

This fact sheet highlights key changes made to the 2016 Title 24, Part 6 Building Energy Efficiency Standards (Energy Code or Title 24, Part 6) and incorporated in the 2019 Energy Code for low-rise residential buildings. The 2019 Energy Code becomes effective January 1, 2020. All measures listed apply to both single-family and low-rise multifamily dwellings unless otherwise noted.

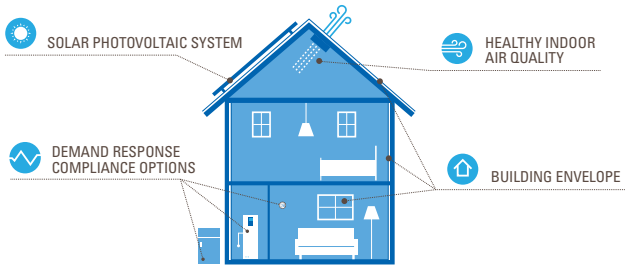

Figure 1– 2019 Energy Code Key Features Modified from California Energy Commission Infographic

Multifamily

Occupancies R-1 and R-2 (R-3 includes single family, duplexes and townhomes 3-habitable stories or less above grade, and is subject to the single-family requirements of the Energy Code):

- Multifamily buildings 3-habitable stories or less above grade are addressed in the **low-rise residential** requirements of the Energy Code (Sections 150.0, 150.1, 150.2)
- Multifamily buildings 4-habitable stories or more above grade are addressed in the **nonresidential, high-rise residential and hotel/motel** requirements of the Energy Code (Sections 110.0, 120.0, 130.0, 141.0)

Why?

Regularly updating the Energy Code helps ensure that builders use the most energy-efficient and energy-conserving technologies and construction practices, while being cost-effective for homeowners over the 30-year lifespan of a building. The California Energy Commission estimates that single-family homes built in compliance with the 2019 Energy Code will use about seven percent less energy due to energy-efficiency measures versus those built under the 2016 code. Once rooftop solar electricity generation is factored in, homes built under the 2019 code will use about 53 percent less energy than those under the 2016 standards. This will reduce greenhouse gas emissions by 700,000 metric tons over three years, equivalent to taking 115,000 fossil fuel cars off the road.

Relevant Code Sections

2019 California Building Energy Efficiency Standards, Title 24, Part 6:

- Section 100.1(b) – Definitions and Rules of Construction: Definitions
- Section 110.6 – Mandatory Requirements: Certification of Fenestration Products and Exterior Doors
- Section 150.0 – Mandatory Features and Devices
  - 150.0(c) – Wall Insulation
  - 150.0(k) – Residential Lighting
  - 150.0(m) – Air-Distribution and Ventilation System Ducts, Plenums, and Fans
  - 150.0(o) – Requirements for Ventilation and Indoor Air Quality
- Section 150.1 – Performance and Prescriptive Compliance Approaches for Low-Rise Residential Buildings
  - 150.1(c) – Prescriptive Standards/Component Package
- Section 150.2 – Energy Efficiency Standards for Additions and Alterations to Existing Low-Rise Residential Buildings
  - 150.2(b) – Alterations
- Joint Reference Appendix JA4.5 – U-factor, C-factor, and Thermal Mass Data: Miscellaneous Construction
- Joint Reference Appendix JA8 – Qualification Requirements for High Efficacy Light Sources

Major Highlights

Natural Gas Availability Section 100.1(b)

A new definition for Title 24, Part 6 clarifies when natural gas must be considered "available." For newly constructed buildings, natural gas is available if a gas service line can be connected to the site without a gas main extension. For additions and alterations, natural gas is available if a gas service line is connected to the existing building.

Mandatory MERV 13 Filters for New Ducted HVAC Section 150.0(m)12

New and complete replacement HVAC systems have new and updated Mandatory air filtration requirements. These apply to ducted forced-air space conditioning systems with over 10 feet of ducts, mechanical supply-only ventilation systems and the supply side of mechanical balanced ventilation systems. One important change is that the required filter efficiency has increased from MERV 6 (nominal 1" thick filter) to MERV 13 (nominal 2" thick filter, or equivalent 1" filter per Equation 150.0-A). Designers should consider how this may impact system design airflow.

PV (Photovoltaics) Section 150.1(c)14

There is a new Prescriptive requirement to install solar PV systems for new residential buildings. The Prescriptive minimum annual kWdc output capacity for the PV system is calculated per Section 150.1(c)14. The sizing calculation is based on conditioned floor area and number of dwelling units per building, with adjustments for Climate Zone and design limitations such as number of habitable stories. The Prescriptive minimum annual PV output is intended to offset the electrical usage of a mixed-fuel home, not including any electricity for space heating or water heating. PV is not required for additions or alterations.

Figure 2 – Solar PV systems on new low-rise residential buildings is a new 2019 Energy Code requirement

QII (Quality Insulation Installation)

HERS-verified QII has changed from a Performance compliance option that offers a large compliance credit compared to the baseline energy budget (the "standard design") to a Prescriptive baseline requirement. This means that QII energy savings for 2019 are already part of the Performance energy budget (Section 150.1(c)1E). This is a major improvement in building envelope insulation and air leakage for new single-family and multifamily residences and additions over 700 ft². When QII is required, it is essential that the builder and/or installer coordinate with the HERS rater to facilitate timely inspections. Note: There is no QII requirement for multifamily buildings in Climate Zone 7.

All-Electric Compliance Options

The 2019 Prescriptive standards now allow all-electric compliance using heat pump space and water heating. This applies to new single-family and multifamily buildings, and also to low-rise residential additions and alterations. Having an all-electric compliance pathway is an important step on the way to California's decarbonization goals.

Tables 150.1-A and B now include Prescriptive heat pump water heating options (see Mechanical Highlights below for more DHW detail). When combined with heat pump space heating, this allows for all-electric as well as mixed-fuel Prescriptive compliance options and adds the option of an all-electric Performance method baseline.

Decarbonization Goals

California is aiming to reduce its greenhouse gas emissions (GHG) while creating an energy system that is resilient to climate risks, spurring innovation and a low-carbon transition nationally and internationally. California's climate goals are among the most ambitious in the country.

	Assembly Bill 32	Senate Bill 32	Executive Order S-3-05
G Emission Reduction Goal	1990 levels by 2020	40% below 1990 levels by 2030	40% below 1990 levels by 2030

To date, the Energy Code has focused on reducing uneconomic, inefficient or unnecessary consumption of energy, as well as enhancing outdoor and indoor environmental quality.

For 2019 and beyond, the Energy Code will maintain its focus on increasing residential building efficiency, while also adopting renewable energy requirements to offset electric energy use and reduce GHG emissions. This can be achieved through a variety of measures, such as incremental steps toward "carbon neutral" buildings, and timely balancing of on-site energy production and consumption in support of a healthy, stable grid.

New Table 150.1-B Component Package for Low-Rise Multifamily

New Table 150.1-B sets out specific Prescriptive requirements for low-rise multifamily. These match the envelope, HVAC and water heating requirements in 2019 Table 150.1-A for single family, except:

- No QII requirement in Climate Zone 7
- R-13 below roof deck insulation is allowed for Roofs/Ceilings Option B in Climate Zones 10 and 16 (ceiling insulation same as Table 150.1-A)
- Exterior Walls: Maximum U-factors for above-grade framed walls are unchanged from 2016 low-rise residential values
  - U factor for Climate Zones 1-5 and 8-16 remains at 0.051
  - U-factor for Climate Zones 6 and 7 is still 0.065

Envelope Highlights

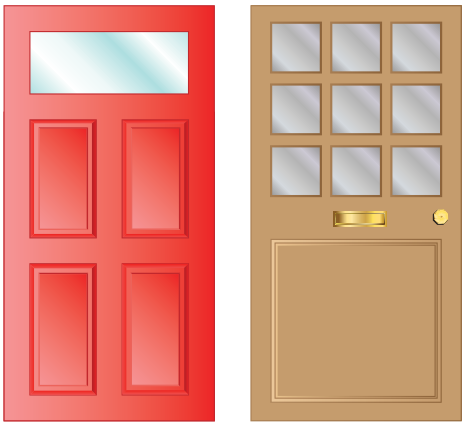

Figure 3 – Opaque Door (v) Glazed Door

New Glazed Door Definition Section 100.1(b): Any door with ≥ 25% glazed area is considered a glazed door, and the entire door must meet applicable fenestration requirements.

Mandatory

Exterior Doors Section 110.6: Exterior Doors must be labeled to indicate compliance with air leakage and U-factor requirements. Default values for doors can be found in Joint Reference Appendix JA4.5

Framed Wall Insulation Sections 150.0(c)2 and 150.0(c)6: All 2x6 framed walls must have a maximum U-factor of 0.071. 2x6 wood-framed walls meet this with ≥ R-20 insulation.

Masonry Wall Insulation Section 150.0(c)5: There is a new Mandatory requirement that all above-grade exterior and demising masonry walls must have either interior or exterior insulation as detailed in Prescriptive Tables 150.1-A and 150.1-B for above-grade mass walls.

Making mass wall insulation Mandatory is a major change to the insulation requirements for masonry walls in all low-rise residential buildings, including both single family and multifamily. It applies to mass walls in new construction, newly conditioned space, additions and alterations.

There is a choice of installing either continuous insulation meeting table R-values or meeting an overall U-factor for the mass wall assembly.

Mass wall insulation requirements based on Climate Zone and insulation location:

Climate Zones 1-15:

- Interior: Continuous insulation ≥ R-13 or assembly U-factor ≤ 0.077 OR
- Exterior: Continuous insulation ≥ R-8 or assembly U-factor ≤ 0.125

Climate Zone 16:

- Interior: Continuous insulation ≥ R-17 or assembly U-factor ≤ 0.059 OR
- Exterior: Continuous insulation ≥ R-13 or assembly U-factor ≤ 0.077

Prescriptive

Fenestration Section 150.1(c)3: Fenestration requirements have tightened incrementally overall:

- Changed maximum U-factor from 0.32 to 0.30 in all Climate Zones
- Changed maximum SHGC from 0.25 to 0.23 in Climate Zones 2, 4 and 6-15; no Prescriptive maximum SHGC in Climate Zones 1, 3, 5 and 16 (new in 16)

Opaque Exterior Doors Section 150.1(c)5: There is a new NFRC-rated maximum U-factor of 0.20 for all swinging exterior doors, including those with < 25% glazed area. This includes doors that separate conditioned space from unconditioned space, except for fire-rated doors between conditioned space and a garage.

Exterior Walls (single family) Section 150.1(c)1Bi: The maximum U-factor for above-grade framed walls in Climate Zones 1-5 and 8-16 changed from 0.051 to 0.048. This U-factor remains 0.065 for Climate Zones 6 and 7.

High Performance Attic (HPA) Option A Removed / Only HPA Option B Remains Sections 150.1(c)1Ai-ii: Only HPA Option B remains as a Prescriptive attic option allowing ducts in a vented attic for new low-rise residential buildings. HPA Option B is limited to attic roofs where there is an air space between the roof deck and the roofing material. This is typically only found in concrete or clay tile roofs. HPA Option B also requires ceiling insulation in all Climate Zones, below roof deck insulation in Climate Zones 4 and 8-16, and radiant barrier in Climate Zones 2, 3, 5, 6 and 7.

New low-rise residential buildings with ducts in a vented attic that do not meet all of the Prescriptive requirements of HPA Option B must show Energy Code compliance using the Performance method.

Mechanical Highlights

Mandatory

Space Conditioning Airflow Rates and Fan Efficacy Section 150.0(m)13: Airflow rates and fan efficacy have changed for certain completely new ducted space conditioning systems that include cooling. Particular system types that have changed include:

- **Single Zone Central Forced Air Systems Section 150.0(m)13B and Zonally Controlled Central Forced Air Systems Section 150.0(m)13C:**
  - For systems with gas furnaces manufactured on or after July 3, 2019, HERS-verified AHU fan efficacy changed from 0.58 to 0.45 W/CFM or less
  - For all other systems, HERS-verified fan efficacy remains at 0.58 W/CFM or less
- **Small Duct High Velocity Forced Air Systems Section 150.0(m)13D:**
  - Airflow for these systems has been reduced from 350 CFM/ton or more to 250 CFM/ton or more, and fan efficacy has changed from 0.58 W/CFM or less to 0.62 W/CFM or less
  - Both airflow and fan efficacy must be HERS-verified.

Ventilation and Indoor Air Quality Section 150.0(o):
All new dwelling units of any size, including ADUs, and additions >1000 ft² must meet 2016 ASHRAE 62.2 ventilation and IAQ requirements as modified in Section 150.0(o)1, and must also comply with Section 150.0(o)2 regarding HERS testing and verification. The 2019 Energy Code increases total ventilation rates required for residences compared to the 2016 code. Important changes include:

- **Single-family residences and townhomes:**
  - Section 150.0(o)1Ci: The Total Required Ventilation Rate is calculated per Equation 150.0-B:
    $Q_{tot} = 0.03(A_{floor}) + 7.5(N_{br} + 1)$
    where:
    Q_{tot} = Total Required Ventilation Rate, CFM
    A_{floor} = Dwelling Unit Floor Area, ft²
    N_{br} = Number of Bedrooms (must be ≥ 1)
  - Sections 150.0(o)1Cii-iii: The required single-family mechanical ventilation rate is calculated by subtracting infiltration from total ventilation (see Sections 150.0(o)1Cii-iii for detailed equations)
- **Multifamily attached dwelling units:**
  - Section 150.0(o)1E: Required total ventilation rates per dwelling unit are calculated using Equation 150.0-B (see above)
  - Sections 150.0(o)1Ei-ii: Multifamily buildings have a choice between two options to provide required ventilation outside air to each unit:
    (1) Install a balanced ventilation system in which both supply and exhaust fans operate simultaneously in response to shared controls, and in which the CFM of mechanically controlled supply outside air and exhaust air are within 20% of each other OR
    (2) Install an unbalanced continuously operating supply ventilation system (supply fans only) or exhaust ventilation system (exhaust fans only) and also HERS-test and verify that the dwelling unit envelope meets certain air-leakage requirements (≤ 2 ACH50)
- **All dwelling units:**
  - Section 150.0(o)1A: Neither single-family nor multifamily residences are allowed to meet ventilation requirements by using operable windows
  - Section 150.0(o)2A: Single-family and multifamily ventilation outdoor airflow must be tested and HERS-verified to meet required rates
- **Kitchen range hoods** when installed require minimum ventilation per 2016 ASHRAE 62.2, Section 5 (Section 150.0(o)2B) and maximum sound rating per 2016 ASHRAE 62.2, Section 7.2 (Section 150.0(o)1G)
  - This corresponds to 100 CFM ventilation for most kitchens and a sound rating of three sones or less
  - A HERS rater must verify that installed range hoods are listed in the HVI Certified Home Ventilating Products Directory and have been HVI-certified as meeting ASHRAE 62.2 ventilation and sound requirements
  - If kitchen range hoods are not installed, ventilation should include minimum 300 CFM exhaust fan or 5 ACH if kitchen is enclosed (Residential Compliance Manual 4.6.7.)

Prescriptive

Electric Heat Pump Water Heaters serving individual dwelling units have new prescriptive compliance options:

- Section 150.1(c)8Av: One NEEA Tier 3 heat pump water heater located in a garage or conditioned space
  - In Climate Zones 1 and 16 also need:
    - PV sized 0.3 kWdc larger than minimum from Section 150.1(c)14 OR
    - HERS-verified compact distribution
- Section 150.1(c)8Aiv: One heat pump water heater (not NEEA Tier 3) in combination with either added PV, or HERS-verified compact distribution and drain water heat recovery

Alterations Section 150.2(b)1Hiiid

An Altered or Replacement Electric Water Heater is allowed if there is no natural gas connected to the existing water heater location. Generally, this means that an existing electric resistance water heater in a room that does not have a natural gas connection can be replaced with another electric resistance water heater.

Lighting Highlights

Mandatory Section 150.0(k)

High Efficacy Light Sources: The 2019 code updates Table 150.0-A light sources classified as high efficacy. High efficacy luminaires as defined by both the 2016 Joint Reference Appendix JA8 and the 2019 JA8 are allowed for the 2019 code cycle. Note, however, that Table 150.0-A includes some high efficacy light sources that do not require JA8 certification.

Night, Step and Path Lights ≤ 5W and ≤ 150 lumens are exempt from high-efficacy and vacancy control requirements.

Lights in Drawers, Cabinets and Linen Closets that are ≤ 5W and ≤ 150 lumens, and that turn off automatically when the drawer, cabinet or closet is closed, are exempt from high efficacy and vacancy control requirements.

Alterations Section 150.2(b)1J

Existing recessed cans do not need to be replaced, but do need to use a JA8 compliant trim kit, or JA8-2016-E or JA8-2019-E lamp.

Performance Highlights

Energy Design Rating (EDR) Compliance for New Residences

The Performance Method compliance metric for new low-rise residential buildings is changing from time-dependent valuation (TDV) energy use per ft² to an Energy Design Rating (EDR). The EDR components include:

- **Energy Efficiency:** Standard Efficiency EDR is based on Table 150.1-A Prescriptive Component Package requirements for building envelope, HVAC system and water heating
- **Solar Electric + Demand Flexibility / PV + Battery Storage**: Standard PV EDR is based on the Prescriptive minimum PV kWdc from Section 150.1(c)14 with no flexibility credit
- **Total Standard EDR** = Standard Efficiency EDR - Standard PV EDR

Proposed Efficiency and PV+Flexibility EDRs are based on the proposed building features.

Total Proposed EDR = Proposed Efficiency EDR - Proposed PV+Flexibility EDR

A new residence complies with the 2019 Energy Code when: Total Proposed EDR ≤ Total Standard EDR.

How Prescriptive for New Residences Changes Performance Options

The Prescriptive PV requirement sets the Performance Standard PV EDR. One straightforward compliance path is to install a PV system that meets the Prescriptive kWdc. It is possible to reduce the required PV kWdc by improving building efficiency beyond the Prescriptive baseline and/or installing ≥ 7.5 kWh battery storage.

The substantial energy-efficiency benefits of QII are now in the Prescriptive baseline setting the Performance Standard Efficiency EDR. However, QII is not a Mandatory measure, so it may be traded away using a combination of other efficiency measures that match QII's high impact. Another QII trade-off option is to install ≥ 5 kWh battery storage to save energy generated by the PV system during the day for use at night (using the Self-Utilization credit).

Incremental tightening of Prescriptive envelope measures other than QII means fewer ways to improve the proposed building envelope in the Performance method. High-efficiency HVAC and water heating are some of the few options to trade off against worse-than-Prescriptive envelope measures. For Climate Zones with substantial cooling loads, building features such as fixed overhangs and side-fins that shade windows and glass doors are also promising Performance options.

Additions and Alterations

Performance method compliance for additions and alterations is still based on TDV energy use per ft² not EDR.

Performance and HERS Verification

The 2019 Energy Code changes some building features that trigger HERS verification when modeled for Performance compliance credit.

There are new HERS-verification requirements for above-standard efficiency EER and HSPF, non-default heat pump rated heating capacity, and whole house fan ventilation.

There are also new HERS requirements for some Mandatory measures, such as checking HVI certification for kitchen range hoods (see Mechanical Highlights above). HERS-verified Mandatory measures do not give Performance compliance credit, but building professionals must know when HERS verification is triggered, regardless of the compliance approach.

For More Information

Primary Documents

- Energy Code Section 100.1(b) – Definitions and Rules of Construction: Definitions
  energycodeace.com/site/custom/public/reference-ace-2019/Documents/section1001definitionsandrulesofconstruction.htm
- Energy Code Section 110.6 – Mandatory Requirements: Certification of Fenestration Products and Exterior Doors
  energycodeace.com/site/custom/public/reference-ace-2019/Documents/section1106mandatoryrequirementsforfenestrationproductsandexteri.htm
- Energy Code Section 150.0 – Mandatory Features and Devices
  energycodeace.com/site/custom/public/reference-ace-2019/Documents/section1500mandatoryfeaturesanddevices.htm
- Energy Code Section 150.0(c) – Mandatory Features and Devices: Wall Insulation
  energycodeace.com/site/custom/public/reference-ace-2019/Documents/section1500mandatoryfeaturesanddevices.htm#cwallinsulation.htm
- Energy Code Section 150.0(k) – Mandatory Features and Devices: Residential Lighting
  energycodeace.com/site/custom/public/reference-ace-2019/Documents/section1500mandatoryfeaturesanddevices.htm#kresidentiallighting.htm
- Energy Code Section 150.0(m) – Mandatory Features and Devices: Air-Distribution and Ventilation System Ducts, Plenums, and Fans
  energycodeace.com/site/custom/public/reference-ace-2019/Documents/section1500mandatoryfeaturesanddevices.htm#mairdistributionandventilationsystemductsplenumsandfans.htm
- Energy Code Section 150.0(o) – Mandatory Features and Devices: Requirements for Ventilation and Indoor Air Quality
  energycodeace.com/site/custom/public/reference-ace-2019/Documents/section1500mandatoryfeaturesanddevices.htm#orequirementsforventilationandindoorairquality.htm
- Energy Code Section 150.1 – Performance and Prescriptive Compliance Approaches for Low-Rise Residential Buildings
  energycodeace.com/site/custom/public/reference-ace-2019/Documents/section1501performanceandprescriptivecomplianceapproachesforlowr.htm
- Energy Code Section 150.1(c) – Performance and Prescriptive Compliance Approaches for Low-Rise Residential Buildings: Prescriptive Standards/Component Package
  energycodeace.com/site/custom/public/reference-ace-2019/Documents/section1501performanceandprescriptivecomplianceapproachesforlowr.htm#cprescriptivestandardscomponentpackage.htm
- Energy Code Section 150.2 – Energy Efficiency Standards for Additions and Alterations to Existing Low-Rise Residential Buildings
  energycodeace.com/site/custom/public/reference-ace-2019/Documents/section1502energyefficiencystandardsforadditionsandalterationsto.htm
- Energy Code Section 150.2(b) – Energy Efficiency Standards for Additions and Alterations to Existing Low-Rise Residential Buildings: Alterations
  energycodeace.com/site/custom/public/reference-ace-2019/Documents/section1502energyefficiencystandardsforadditionsandalterationsto.htm#balterations2.htm
- Energy Code Joint Reference Appendix JA4.5 – U-factor, C-factor, and Thermal Mass Data: Miscellaneous Construction
  energycodeace.com/site/custom/public/reference-ace-2019/Documents/ja45miscellaneousconstruction.htm
- Energy Code Joint Reference Appendix JA8 – Qualification Requirements for High Efficacy Light Sources
  energycodeace.com/site/custom/public/reference-ace-2019/Documents/appendixja8qualificationrequirementsforhighefficacylightsources.htm

California Energy Commission Information & Services

- Energy Standards Hotline: 1-800-772-3300 (Free) or Title24@energy.ca.gov
- Online Resource Center:
  energy.ca.gov/programs-and-topics/programs/building-energy-efficiency-standards/online-resource-center
  – The Energy Commission's main web portal for Energy Standards, including information, documents, and historical information

Additional Resources

- ASHRAE Technical Standards Bookstore (for ANSI/ASHRAE Standards 62.1 and 62.2)
  ashrae.org/technical-resources/bookstore/standards-62-1-62-2
- HVI Certified Home Ventilating Products Directory
  hvi.org/hvi-certified-products-directory/
- California Association of Building Energy Consultants (CABEC) Webinar
  – What's New for Multifamily Ventilation in 2019
  cabec.org/learning/
- Energy Code Ace:
  EnergyCodeAce.com
  – An online "one-stop-shop" providing free resources and training to help appliance and building industry professionals decode and comply with Title 24, Part 6 and Title 20. The site is administered by California's investor-owned utilities.
  Of special interest:
  - Fact Sheets
    energycodeace.com/content/resources-fact-sheets/
    – What's Changed for 2019: Low-Rise Residential
    – Residential High-Efficacy Lighting - Title 20 and Title 24, Part 6 JA8: Key Differences and Overlap
  - Reference Ace™ – Easily navigate Title 24, Part 6 documents using search and hyperlinks
    energycodeace.com/content/tools-ace/tool=reference-ace
    – 2019 Energy Code
    – 2016 Energy Code
  - Training
    energycodeace.com/training
    – Title 24: Where We're Headed with the 2019 Standards
    – 2019 Title 24, Part 6: Where We're Headed with the Residential Standards
    – Decoding What's New: Let's Talk 2019 Title 24, Part 6 – Residential
  - Energy Code Ace Tools, Training and Resources Updated for the 2019 Code – More Coming Soon! Create an account on EnergyCodeAce.com and select a role in My Profile to receive emails when they're published.

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