

2019 Low-Rise Residential Mandatory Measures Summary	
§ 150.0(h)3a	<b>Clearances.</b> Air conditioner and heat pump outdoor condensing units must have a clearance of at least five feet from the outlet of any dryer.
§ 150.0(h)3b	<b>Liquid Line Drains.</b> Air conditioners and heat pump systems must be equipped with liquid line filter driers if required, as specified by the manufacturer's instructions.
§ 150.0(g)1	<b>Storage Tank Insulation.</b> Unlined hot water tanks, such as storage tanks and backup storage tanks for solar water-heating systems, must have a minimum of R-12 exterior insulation or R-16 internal insulation where the internal insulation R-value is indicated on the exterior of the tank.
§ 150.0(g)2A	<b>Water Piping, Solar Water-Heating System Piping, and Space Conditioning System Line Insulation.</b> All domestic hot water piping must be installed as specified in Section 103.111 of the California Plumbing Code. In addition, the following piping conditions must have a minimum insulation wall thickness of one inch or a minimum insulation R-value of 7.7: the first five feet of cold water pipes from the storage tank; all hot water piping with a nominal diameter equal to or greater than 3/4 inch and less than one inch; all hot water piping with a nominal diameter less than 3/4 inch that is associated with a domestic hot water recirculation system, from the heating source to storage tank or between tanks; buried below grade; and from the heating source to kitchen fixtures.
§ 150.0(g)3	<b>Insulation Protection.</b> Piping insulation must be protected from damage, including that due to sunlight, moisture, equipment maintenance, and wind as required by Section 120.3(b). Insulation exposed to weather must be water resistant and protected from UV light (no adhesive tapes). Insulation covering chilled water piping and refrigerant suction piping located outside the conditioned space must include, or be protected by, a Class I or Class II vapor retarder. Pipe insulation buried below grade must be installed in a waterproof and non-rottable casing or sleeve.
§ 150.0(h)1	<b>Gas or Propane Water Heating Systems.</b> Systems using gas or propane water heaters to serve individual dwelling units must include all of the following: A dedicated 125 volt, 20 amp electrical receptacle connected to the electric panel with a 120/240 volt 3 conductor, 10 AWG copper branch circuit, within three feet of the water heater without obstruction. Both ends of the unused conductor must be labeled with the word "span" and be electrically isolated. Have a reserved single pole circuit breaker space in the electrical panel adjacent to the circuit breaker for the branch circuit and labeled with the words "Future 240V Use", a Category III or IV vert., or a Type B vent with straight pipe between the outside termination and the space where the water heater is installed, a condensate drain that is no more than two inches higher than the base of the water heater, and allow natural drainage without pump assistance, and a gas supply line with a capacity of at least 200,000 Btu per hour.
§ 150.0(h)2	<b>Recirculating Loops.</b> Recirculating loops serving multiple dwelling units must meet the requirements of § 110.3(e)5.
§ 150.0(h)3	<b>Solar Water-Heating Systems.</b> Solar water-heating systems and collectors must be certified and rated by the Solar Rating and Certification Corporation (SRCC), the International Association of Plumbing and Mechanical Officials, Research and Testing (IAPMO RBT), or by a listing agency that is approved by the Executive Director.
<b>Ducts and Fans Measures:</b>	
§ 110.4(b)3	<b>Ducts.</b> Insulation installed on an existing space-conditioning duct must comply with Section 5404.0 of the California Mechanical Code (CMC), if a contractor installs the insulation, the contractor must certify to the customer, in writing, that the insulation meets the requirement.
§ 150.0(g)1	<b>CMC Compliance.</b> All air-distribution system ducts and plenums must meet the requirements of the CMC §§ 501.10, 602.0, 603.0, 604.0, 606.0 and 610.0 (CMC 2014-100-200). HVAC Duct Construction Standards Metal and Flexible, 3rd Edition. Portions of supply air and return air ducts and plenums must be insulated to a minimum installed level of R-6 or a minimum installed level of R-4.2 when ducts are entirely in conditioned space as confirmed through field verification and diagnostic testing (RAC 14.3.8). Portions of the duct system completely exposed and surrounded by directly conditioned space are not required to be insulated. Connections of metal ducts and inner core of flexible ducts must be mechanically fastened. Openings must be sealed with mastic, tape, or other duct-closure system that meets the applicable requirements of UL 181, UL 181A, or UL 181B or aerosol sealant that meets the requirements of UL 723. If mastic or tape is used to seal openings greater than 1/4 inch, the combination of mastic and either mesh or tape must be used. Building cavities, support platforms for air handlers, and plenums designed or constructed with materials other than sealed sheet metal, duct board or flexible duct must not be used to convey conditioned air. Building cavities and support platforms may contain ducts. Ducts installed in cavities and support platforms must not be compressed to cause reductions in the cross-sectional area.
§ 150.0(h)2	<b>Factory-Fabricated Duct Systems.</b> Factory-fabricated duct systems must comply with applicable requirements for duct construction, connections, and closures, joints and seams of duct systems and their components must not be sealed with cloth back rubber adhesive duct tapes unless such tape is used in combination with mastic and draw bands.
§ 150.0(h)3	<b>Field-Fabricated Duct Systems.</b> Field-fabricated duct systems must comply with applicable requirements for pressure-sensitive tapes, mastics, sealants, and other requirements specified for duct construction.
§ 150.0(h)7	<b>Backdraft Damper.</b> Fan systems that exchange air between the conditioned space and outdoors must have backdraft or automatic dampers.
§ 150.0(h)9	<b>Gravity Ventilation Dampers.</b> Gravity ventilation systems serving conditioned space must have either automatic or readily accessible, manually operated dampers in all openings to the outside, except combustion inlet and outlet air openings and elevator shaft vents.
§ 150.0(h)9	<b>Protection of Insulation.</b> Insulation must be protected from damage, sunlight, moisture, equipment maintenance, and wind. Insulation exposed to weather must be suitable for outdoor service. For example, protected by aluminum, steel metal, painted canvas, or plastic cover. Cellular foam insulation must be protected as above or painted with a coating that is water resistant and provides shielding from solar radiation.
§ 150.0(h)10	<b>Porous Inner Core Flex Duct.</b> Porous inner core flex ducts must have a non-porous layer between the inner core and outer vapor barrier.
§ 150.0(h)11	<b>Duct System Sealing and Leakage Test.</b> When space conditioning systems use forced air duct systems to supply conditioned air to an occupiable space, the ducts must be sealed and duct leakage tested, as confirmed through field verification and diagnostic testing in accordance with § 150.0(h)11 and Reference Residential Appendix RAC3.
§ 150.0(h)12	<b>Air Filtration.</b> Space conditioning systems with ducts exceeding 10 feet and the supply side of ventilation systems must have MERV 13 or equivalent filters. Filters for space conditioning systems must have a two inch depth or can be one inch if sized per Equation 150.0.A. Pressure drops and labeling must meet the requirements in § 150.0(h)12. Filters must be accessible for regular service.
§ 150.0(h)13	<b>Space Conditioning System Airflow Rate and Fan Efficiency.</b> Space conditioning systems that use ducts to supply cooling must have a hole for the placement of a static pressure probe, or a permanently installed static pressure probe in the supply plenum. Airflow must be ≥ 250 CFM per ton of nominal cooling capacity, and an air-handling unit fan efficiency ≥ 0.45 watts per CFM for gas furnace air handlers and ≥ 0.35 watts per CFM for all others. Small duct high velocity systems must provide an airflow ≥ 250 CFM per ton of nominal cooling capacity, and an air-handling unit fan efficiency ≥ 0.62 watts per CFM. Field verification testing is required in accordance with Reference Residential Appendix RAC 3.

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<b>Requirements for Ventilation and Indoor Air Quality:</b>	
§ 150.0(g)1	<b>Requirements for Ventilation and Indoor Air Quality.</b> All dwelling units must meet the requirements of ASHRAE Standard 62.2, Ventilation and Acceptable Indoor Air Quality in Residential Buildings subject to the amendments specified in § 150.0(g)1.
§ 150.0(g)1C	<b>Single Family Detached Dwelling Units.</b> Single family detached dwelling units, and attached dwelling units not sharing ceilings or floors with other dwelling units, occupiable spaces, public garages, or commercial spaces must have mechanical ventilation airflow provided at rates determined by ASHRAE 62.2 Sections 4.1.1 and 4.1.2 and as specified in § 150.0(g)1C.
§ 150.0(g)1E	<b>Multifamily Attached Dwelling Units.</b> Multifamily attached dwelling units must have mechanical ventilation airflow provided at rates in accordance with Equation 150.0.B and must be either a balanced system or continuous supply or continuous exhaust system. If a balanced system is not used, all units in the building must use the same system type and the dwelling unit envelope leakage must be ≤ 0.3 CFM at 50 Pa (0.2 inch water) per square foot of dwelling unit envelope surface area and verified in accordance with Reference Residential Appendix RAC 8.
§ 150.0(g)1F	<b>Multifamily Building Central Ventilation Systems.</b> Central ventilation systems that serve multiple dwelling units must be balanced to provide ventilation airflow for each dwelling unit served at a rate equal to or greater than the rate specified by Equation 150.0.B. All unit airflows must be within 20 percent of the unit with the lowest airflow rate; it relates to the individual unit's minimum required airflow rate needed for compliance.
§ 150.0(g)1G	<b>Kitchen Range Hoods.</b> Kitchen range hoods must be rated for sound in accordance with Section 7.2 of ASHRAE 62.2.
§ 150.0(g)2	<b>Field Verification and Diagnostic Testing.</b> Dwelling unit ventilation airflow must be verified in accordance with Reference Residential Appendix RAC 7. A kitchen range hood must be verified in accordance with Reference Residential Appendix RAC 7.4.3 to confirm it is rated to 120 to comply with the airflow rates and sound requirements as specified in Section 5 and 7.2 of ASHRAE 62.2.
<b>Pool and Spa Systems and Equipment Measures:</b>	
§ 110.4(a)	<b>Certification by Manufacturers.</b> Any pool or spa heating system or equipment must be certified to have all of the following: a thermal efficiency that complies with the Appliance Efficiency Regulations, an on/off switch mounted on the heater that allows shutting off the heater without adjusting the thermostat setting, a permanent weatherproof plate or card with operating instructions, and must not use electric resistance heating.
§ 110.4(b)1	<b>Piping.</b> Any pool or spa heating system or equipment must be installed with at least 3/8 inches of pipe between the filter and the heater, or dedicated suction and return lines, or built-in or built-up connections to allow for future solar heating.
§ 110.4(b)2	<b>Covers.</b> Outdoor pools or spas that have a heat pump or gas heater must have a cover.
§ 110.4(b)3	<b>Directional Inlets and Time Switches for Pools.</b> Pools must have directional inlets that adequately mix the pool water, and a time switch that will allow all pumps to be set or programmed to run only during off-peak electric demand periods.
§ 110.5	<b>Pilot Light.</b> Natural gas pool and spa heaters must not have a continuously burning pilot light.
§ 150.0(g)	<b>Pool Systems and Equipment Installation.</b> Residential pool systems or equipment must meet the specified requirements for pump sizing, flow rate, piping, filters, and valves.
<b>Lighting Measures:</b>	
§ 110.9	<b>Lighting Controls and Components.</b> All lighting control devices and systems, ballasts, and luminaires must meet the applicable requirements of § 110.9.
§ 150.0(h)1A	<b>Luminaire Efficacy.</b> All installed luminaires must meet the requirements in Table 150.0.A.
§ 150.0(h)1B	<b>Blank Electrical Boxes.</b> The number of electrical boxes that are more than five feet above the finished floor and do not contain a luminaire or other device must be no greater than the number of bedrooms. These electrical boxes must be covered by a dimmer, vacancy sensor control, or fan speed control.
§ 150.0(h)1C	<b>Recessed Downlight Luminaires in Ceilings.</b> Luminaires recessed into ceilings must meet all of the requirements for insulation contact (IC) labeling, air leakage, sealing, maintenance, and socket and light source as described in § 150.0(h)1C.
§ 150.0(h)1D	<b>Electronic Ballasts for Fluorescent Lamps.</b> Ballasts for fluorescent lamps rated 13 watts or greater must be electronic and must have an output frequency no less than 20 kHz.
§ 150.0(h)1E	<b>Night Lights, Step Lights, and Path Lights.</b> Night lights, step lights and path lights are not required to comply with Table 150.0.A or be controlled by vacancy sensors provided they are rated to consume no more than 2 watts of power and emit no more than 150 lumens.
§ 150.0(h)1F	<b>Lighting Integral to Exhaust Fans.</b> Lighting integral to exhaust fans (except when installed by the manufacturer in kitchen exhaust hoods) must meet the applicable requirements of § 150.0(h)1F.
§ 150.0(h)1G	<b>Screw based luminaires.</b> Screw based luminaires must contain lamps that comply with Reference Joint Appendix J48.
§ 150.0(h)1H	<b>Light Sources in Enclosed or Recessed Luminaires.</b> Lamps and other separable light sources that are not compliant with the J48 elevated temperature requirements, including marking requirements, must not be installed in enclosed or recessed luminaires.
§ 150.0(h)1I	<b>Light Sources in Drawers, Cabinets, and Linen Closets.</b> Light sources internal to drawers, cabinetry or linen closets are not required to comply with Table 150.0.A or be controlled by vacancy sensors provided that they are rated to consume no more than 5 watts of power, emit no more than 150 lumens, and are equipped with controls that automatically turn the lighting off when the drawer, cabinet or linen closet is closed.
§ 150.0(h)2A	<b>Interior Switches and Controls.</b> All forward phase-out dimmers used with LED light sources must comply with NEMA SSL-7A.
§ 150.0(h)2B	<b>Interior Switches and Controls.</b> Exhaust fans must be controlled separately from lighting systems.
§ 150.0(h)2C	<b>Interior Switches and Controls.</b> Lighting must be readily accessible wall-mounted controls that allow the lighting to be manually turned ON and OFF.
§ 150.0(h)2D	<b>Interior Switches and Controls.</b> Controls and equipment must be installed in accordance with manufacturer's instructions.
§ 150.0(h)2E	<b>Interior Switches and Controls.</b> Controls must not bypass a dimmer, occupant sensor, or vacancy sensor function if the control is installed to comply with § 150.0(h)2.
§ 150.0(h)2F	<b>Interior Switches and Controls.</b> Lighting controls must comply with the applicable requirements of § 110.9.

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§ 150.0(h)2G	<b>Interior Switches and Controls.</b> An energy management control system (EMCS) may be used to comply with control requirements if it provides functionality of the specified control according to § 110.9, meets the Installation Certificate requirements of § 130.4, meets the EMCS requirements of § 130.0(e), and meets all other requirements in § 150.0(h)2.
§ 150.0(h)2H	<b>Interior Switches and Controls.</b> A multi-line programmable controller may be used to comply with dimmer requirements in § 150.0(h)2 if it provides the functionality of a dimmer according to § 110.9, and complies with all other applicable requirements in § 150.0(h)2.
§ 150.0(h)2I	<b>Interior Switches and Controls.</b> In bedrooms, garages, laundry rooms, and utility rooms, at least one luminaire in each of these spaces must be controlled by an occupant sensor or a vacancy sensor providing automatic-off functionality. If an occupant sensor is installed, it must be initially configured to manual on operation using the manual control required under Section 150.0(h)2C.
§ 150.0(h)2J	<b>Interior Switches and Controls.</b> Luminaires that are or contain light sources that meet Reference Joint Appendix J48 requirements for dimming, and that are not controlled by occupancy or vacancy sensors, must have dimming controls.
§ 150.0(h)2K	<b>Interior Switches and Controls.</b> Under cabinet lighting must be controlled separately from ceiling-installed lighting systems.
§ 150.0(h)3A	<b>Residential Outdoor Lighting.</b> For single-family residential buildings, outdoor lighting permanently mounted to a residential building, or to other buildings on the same lot, must meet the requirements in Item § 150.0(h)3A (ON and OFF switch) and the requirements in either § 150.0(h)3A (photocell) or either a motion sensor or automatic time switch control or § 150.0(h)3A (photocell time clock), or an EMCS.
§ 150.0(h)3B	<b>Residential Outdoor Lighting.</b> For low-rise residential buildings with four or more dwelling units, outdoor lighting for private patios, terraces, balconies, and porches, and residential parking lots and carports with less than eight vehicles per site must comply with either § 150.0(h)3A or with the applicable requirements in Sections 110.9, 130.0, 130.2, 130.4, 140.7 and 141.0.
§ 150.0(h)3C	<b>Residential Outdoor Lighting.</b> For low-rise residential buildings with four or more dwelling units, any outdoor lighting for residential parking lots or carports with at least eight or more vehicles per site and any outdoor lighting not regulated by § 150.0(h)3B or § 150.0(h)3D must comply with the applicable requirements in Sections 110.9, 130.0, 130.2, 130.4, 140.7 and 141.0.
§ 150.0(h)4	<b>Internally Illuminated Address Signs.</b> Internally illuminated address signs must comply with § 140.6, or must consume no more than 5 watts of power as determined according to § 130.0(c).
§ 150.0(h)5	<b>Residential Garages for Eight or More Vehicles.</b> Lighting for residential parking garages for eight or more vehicles must comply with the applicable requirements for residential garages in Sections 110.9, 130.0, 130.1, 130.4, 140.6, and 141.0.
§ 150.0(h)5A	<b>Interior Common Areas of Low-rise Multifamily Residential Buildings.</b> In a low-rise multifamily residential building where the total interior common area in a single building equals 20 percent or less of the floor area, permanently installed lighting for the interior common areas in that building must be in accordance with Table 150.0.A and be controlled by an occupant sensor.
§ 150.0(h)5B	<b>Interior Common Areas of Low-rise Multifamily Residential Buildings.</b> In a low-rise multifamily residential building where the total interior common area in a single building equals more than 20 percent of the floor area, permanently installed lighting for the interior common areas in that building must: 1. Comply with the applicable requirements in Sections 110.9, 130.0, 130.1, 140.6 and 141.0, and 2. A lighting installed in corridors and stairwells must be controlled by occupant sensors that reduce the lighting power in each space by at least 50 percent. The occupant sensors must be capable of turning the light fully on and off from all designated paths of ingress and egress.
<b>Solar Ready Buildings:</b>	
§ 110.10(a)1	<b>Single Family Residences.</b> Single family residences located in subdivisions with 10 or more single family residences and where the application for a tentative subdivision map for the residences has been deemed complete and approved by the enforcement agency, which do not have a photovoltaic system installed, must comply with the requirements of § 110.10(b) through § 110.10(d).
§ 110.10(a)2	<b>Low-rise Multifamily Buildings.</b> Low-rise multifamily buildings that do not have a photovoltaic system installed must comply with the requirements of § 110.10(b) through § 110.10(d).
§ 110.10(b)1	<b>Minimum Solar Zone Area.</b> The solar zone must have a minimum total area as described below. The solar zone must comply with access, pathway, smoke ventilation, and spacing requirements as specified in Title 24, Part 9, or other parts of Title 24 or in any requirements adopted by a local jurisdiction. The solar zone total area must be comprised of areas that have no dimension less than 5 feet and are no less than 50 square feet each for buildings with roof areas less than or equal to 10,000 square feet or no less than 160 square feet each for buildings with roof areas greater than 10,000 square feet. For single family residences, the solar zone must be located on the roof or overhang of the building and have a total area no less than 15 percent of the total roof area of the building, or on covered parking installed with the building project, and have a total area no less than 15 percent of the total roof area of the building excluding any skylight area. The solar zone requirement is applicable to the entire building, including mixed occupancy.
§ 110.10(b)2	<b>Azimuth.</b> All sections of the solar zone located on steep-sloped roofs must be oriented between 90 degrees and 300 degrees of true north.
§ 110.10(b)3A	<b>Shading.</b> The solar zone must not contain any obstructions, including but not limited to: vents, chimneys, architectural features, and roof-mounted equipment.
§ 110.10(b)3B	<b>Shading.</b> Any obstruction located on the roof or any other part of the building that projects above a solar zone must be located at least twice the distance, measured in the horizontal plane, of the height difference between the highest point of the obstruction and the horizontal projection of the nearest point of the solar zone, measured in the vertical plane.
§ 110.10(b)4	<b>Structural Design Loads on Construction Documents.</b> For areas of the roof designated as a solar zone, the structural design loads for roof dead load and roof live load must be clearly indicated on the construction documents.
§ 110.10(c)	<b>Interconnection Pathways.</b> The construction documents must indicate a location reserved for inverters and metering equipment and a pathway reserved for routing of conduit from the solar zone to the point of interconnection with the electrical service, and for single family residences and central water-heating systems, a pathway reserved for routing plumbing from the solar zone to the water-heating system.
§ 110.10(d)	<b>Documentation.</b> A copy of the construction documents or a comparable document indicating the information from § 110.10(b) through § 110.10(d) must be provided to the occupant.
§ 110.10(e)1	<b>Main Electrical Service Panel.</b> The main electrical service panel must have a minimum busbar rating of 200 amps.
§ 110.10(e)2	<b>Main Electrical Service Panel.</b> The main electrical service panel must have a reserved space to allow for the installation of a double pole circuit breaker for a future solar electric installation. The reserved space must be permanently marked as "For Future Solar Electric."

HVAC SYSTEM HEATING AND COOLING LOADS SUMMARY					
Project Name Matangi JADU					Date 6/11/2021
System Name HVAC System					Floor Area 329
<b>ENGINEERING CHECKS</b>			<b>SYSTEM LOAD</b>		
Number of Systems	1		<b>COIL COOLING PEAK</b>		<b>COIL HTG. PEAK</b>
<b>Heating System</b>			<b>CFM</b>	<b>Sensible</b>	<b>Latent</b>
Output per System	12,000		167	3,597	113
Total Output (Btu/h)	12,000				
Output (Btu/h/ft <sup>2</sup> )	36.5				
<b>Cooling System</b>			<b>CFM</b>	<b>Sensible</b>	
Output per System	12,000				
Total Output (Btu/h)	12,000				
Total Output (Tons)	1.0				
Total Output (Btu/h/ft <sup>2</sup> )	36.5				
Total Output (sq/ft)	329.0		3,597	113	3,477
<b>Air System</b>			<b>HVAC EQUIPMENT SELECTION</b>		
CFM per System	0		Ductless Heat Pump		
Airflow (cfm)			11,320	0	8,117
Airflow (cfm/sqft)					
Airflow (cfm/ft)					
Outside Air (cfm)					
Outside Air (cfm/sqft)					
Outside Air (cfm/ft)					
Total Adjusted System Output (Adjustes for Peak Design conditions)			11,320	0	8,117
Notes: values above given at ARI conditions			<b>TIME OF SYSTEM PEAK</b>		
			Aug 3 PM		
			Jan 1 AM		
<b>HEATING SYSTEM PSYCHROMETRICS (Airstream Temperatures at Time of Heating Peak)</b>					
Outside Air	68 °F	Heating Coil	105 °F	ROOM	68 °F
0 cfm					
<b>COOLING SYSTEM PSYCHROMETRICS (Airstream Temperatures at Time of Cooling Peak)</b>					
Outside Air	87 / 65 °F	Cooling Coil	75 / 61 °F	ROOM	55 / 53 °F
0 cfm					
44.3%					

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