

Proposal Summary



Multifamily Domestic Hot Water Systems

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Prepared by: Jingjuan “Dove” Feng, Amin Delagah, and Jose Garcia, TRC; James Haile, Frontier Energy

Introduction

The document summarizes proposed revisions to the California Energy Code (Title 24, Part 6) that will be discussed during a utility-sponsored stakeholder meeting on February 17, 2023. The Statewide Utility Codes and Standards Enhancement (CASE) Team is seeking input and feedback. To provide your comments, email info@title24stakeholders.com by March 3rd, 2023.

Measure Description

The Multifamily Domestic Hot Water Systems topic covers measures related to hot water distribution, heat pumps systems, and electric readiness, as described below.

California Plumbing Code (CPC) Appendix M Pipe Sizing

This measure would add a prescriptive requirement for pipe sizing according to CPC Appendix M (IAPMO 2019). The California Building Standards Commission Advisory Committee is considering the adoption of Appendix M in their intervening code adoption cycle in 2022. This measure is contingent on the California Department of Housing and Community Development (HCD) adopting Appendix M and applies to both individual and central systems.

Pipe Insulation Enhancement

This measure would add a prescriptive requirement for field verification of pipe insulation quality. The measure would also focus on investigating the pipe insulation requirements of sections 160.4 for possible cleanup. These sections would require that all appurtenances (pumps, valves, strainers, etc.) in series in the DHW system heating plant and recirculation loop be insulated. It would add a requirement for insulating pipe supports or hangers. Continuous pipe insulation requirements at the heating plant and recirculation loop including hangers and appurtenances would reduce pipe heat losses by ensuring all exposed elements are insulated. It adds installation quality requirements to seal seams, use extended stem isolation valves and specific insulation installation



practices for tees and elbows. The measure adds space cooling and heating pipe insulation language from section 120.3. The clarifications to section 160.4 should simplify pipe insulation verification.

Require Balancing Valves

This measure would add a compliance option for thermostatic (thermal) balancing valves for each riser or zone (minimum of two) in combination with installation of variable speed pumps with differential pressure control on a centralized DHW system with recirculation. This compliance option would be available to distribution systems with smaller circulation systems as determined by calculating the total developed length of the circulation return piping. This measure is also applicable to additions and alterations of existing buildings, and is most likely to apply when the heating plant is being replaced at end of life.

Master Mixing Valves

This measure would add a mandatory measure to install thermostatic master mixing valves (MMV) on the centralized heating plant hot water supply outlet header leading to the recirculation loop. Also, this measure would add a compliance credit to install digital MMV on central distribution systems with continuous recirculation. MMVs are traditionally used to mitigate pathogen growth and scalding risk, but research has shown that they offer energy saving benefits from lower recirculation loop heat losses and improved tank water temperature stratification versus mixing or tempering the hot water at each dwelling unit. MMVs precisely control the distribution supply temperature and redirect the warm return water back to the distribution system and away from the water heating plant. MMVs enhance load shifting capabilities with HP based heating plants and provide the ability to safely increase storage heating capacity of the heating plant without adding additional storage volume.

Demand Control Clean-up

The CASE team proposes to remove the prescriptive requirement for demand recirculation systems serving multiple dwelling units to align with technical considerations for multifamily applications (Prescriptive)

Individual HPWH Ventilation

This measure would establish ventilation criteria and requirements for consumer individual HPWHs. The CASE Team will evaluate ventilation approaches such as ducting and net free area for louvered doors, and venting sources (indoor vs. outdoor). Savings per dwelling unit are expected to be the same for both multifamily and single family. The measure would include mandatory requirements for minimum ventilation for

all occupancies. This includes requirements for ventilation with three installation methods:

- Large unvented room, with minimum room volume of 100 ft³ / kBtu/h of compressor capacity or manufacturer provided requirements.
- Small vented room.
 - Minimum room volume of 20 ft³ / kBtu/h of compressor capacity or manufacturer provided requirements.
 - Larger of 125 in² plus 25 in² per kBtu of compressor capacity net free area or manufacturer provided requirements.
- Directly ducted in any size room, with some basic requirements like insulating the exhaust duct and sealing joints.
- Novel ventilation methods approved by the manufacturer and included in permit application.

Central HPWH Cleanup

For the 2022 code cycle, the Statewide CASE Team developed an alternate compliance pathway for central HPWH systems. The prescriptive requirements include basic equipment, plumbing, control, and design documentation requirements. It provides prescriptive compliance pathway for a wide range of central HPWH design options. This measure would improve the current prescriptive requirement by:

- Revising the prescriptive pathway(s) for alternative DHW plant design and control approaches to ensure minimum energy efficiency and system reliability. The measure proposal would leverage recent modeling capability, field study and lab testing data to evaluate HPWH equipment options and design configurations.
- Establishing minimum system efficiency requirements leveraging the Northwest Energy Efficiency Alliance (NEEA)'s Advanced Water Heating Specification V8.0 for commercial HPWH system.

Central DHW Electric-Ready

The central DHW electric readiness mandatory measure would add electrical, space, ventilation, and condensate requirements at the time of construction to accommodate the future retrofit or replacement of fossil-fuel burning devices with electricity-powered devices. Specific requirements include:

- Physical space to accommodate electric water heating equipment and storage requirements in the future;
- Identification of ventilation access;
- Installation of condensate drain lines;

- Electrical system sizing and design to accommodate shifts to electric devices in the future; and
- Design documentations that the building design meets the requirements, to be approved by certified professionals.

Individual DHW Electric-Ready Cleanup

This mandatory measure would evaluate the current code language requirement for a "dedicated 125-volt, 20-amp electrical receptacle that is connected to the electric panel with a 120/240-volt 3 conductor, 10 AWG copper branch circuit", considering the distance between the main panel and water heater location. The CASE Team proposes revising the size to be rated at 30A to accommodate concerns about the likely voltage drop in multifamily applications. In addition, the CASE Team proposes new requirements including minimum space requirements and minimum ventilation requirements.

Data Needs/Stakeholder Information Requests

Data may be provided anonymously. To participate or provide information, please email Dove Feng, jfeng@trccompanies.com directly and cc info@title24stakeholders.com.

California Plumbing Code (CPC) Appendix M Pipe Sizing

- What standard or method do you use to size piping in MF buildings?
- Have you sized piping using Appendix M? If no, why not? If yes, do you have any concerns or feedback on the design, submittal or installation process?
- Would you size piping using Appendix M if it is adopted by the CPC as an alternative pipe sizing methodology?

Pipe Insulation Enhancement

- On a percentage basis, how often is pipe insulation not installed according to drawings and instructions?
- What standard pipe insulation requirements do you provide on drawings as a designer or apply from drawings as an installer?
- What are the typical field issues encountered with pipe insulation installs? Here is a list of example issues: gaps, insulation thickness doesn't meet code minimum, damaged insulation, uninsulated fittings or valves, uninsulated pipe supports, and direct contact with metal pipe hangers to pipe.

Require Balancing Valves

- What balancing valve products are commonly installed in multi-riser systems?

- Can the installation of automatic balancing valves reduce installation costs as compared to the installation of manual balancing valves?
- What is common practice for balancing manual valves serving multi-riser distribution systems, and how does this impact installed performance?
- Can thermal balancing valves in combination with variable speed pumps be used to reduce hot water recirculation heat losses as compared to current industry practice?

Master Mixing Valves

- What types of master mixing valves do you specify or install in MF central hot water systems with continuous recirculation? Here is a list of example types: Thermostatic/Mechanical 1) Paraffin wax, 2) Liquid filled bellows, 3) Bi-metal, 4) Digital/Electronic
- Do you install parallel MMVs for backup purposes or to conduct routine maintenance?
- Do you see maintenance issues with thermostatic or digital MMVs?
- What performance, cost or reliability factors influences your MMV specification?

Demand Control Clean-up

- What is current practice in the industry, and are there performance concerns?
- Is it possible to capture the energy savings potential of demand control with another method of pump/distribution system control?

Individual HPWH Ventilation

- **Technical Feasibility**
 1. What is the typical DHW room size?
 2. How common is ducting in HPWH installs?
 3. What is the current practice to determine if a HPWH should be ducted or not?
- **Market Readiness**
 1. Are there unitary HPWH models available that do not provide a ducted option?
 2. What is currently used for ducting with HPWHs?
 3. For installers who have been called back to a site for HPWH issues, what have the issues been and how were they resolved?
 - Condensation in ducting?
 - Noise?

4. What commissioning steps can be required of installers to ensure performance?
- **Costs**
 - What would be the incremental cost of ducting if the space in the DHW room was insufficient and could not otherwise be vented?
 - What are the costs associated with marking the minimum clearances for the HPWH on the floor around its installed location if installed in a room with a volume less than 700 cu. Ft.?

Central HPWH Clean up

- What are the different design configurations that the code needs to address?
- How does each central HPWH design configuration compare to each other in terms of cost and energy efficiency?

Central DHW Electric-Ready

- During the new building design process, what planning needs to be done to make the central heat pump water heater electric ready?
- What other infrastructure needs to be installed during new-construction to make the central water heater electric-ready?

Individual DHW Electric-Ready Cleanup

- Is a 20-amp circuit undersized for certain applications?
- What should the code require to ensure adequate ventilation is available for the future heat pump water heater?
- During the new building design process, what planning needs to be done to make the individual heat pump water heater electric ready?
- What other infrastructure needs to be installed during new-construction to make the individual water heater electric-ready?

Draft Code Language

The proposed changes to the Standards and Reference Appendices are provided below. Changes to the 2022 documents are marked with red underlining (new language) and ~~strikethroughs~~ (deletions). Expected sections or tables of the proposed code (but not specific changes at this time) are highlighted in **yellow**.

Standards

SECTION 100.1 – DEFINITIONS AND RULES OF CONSTRUCTION

Section 100.1(b) – Definitions: Recommends new or revised definitions for the following terms:

AIR-TO-WATER HEAT PUMP (AWHP) is a factory-made packaged heat pump system containing one or more compressors, refrigerant-to-air and refrigerant-to-water heat exchangers, and other components for providing heated or cooled water for satisfying space conditioning loads, and in some cases domestic hot water requirements.

HEAT PUMP WATER HEATER (HPWH) is a water heater that transfers thermal energy from one temperature level to a another higher temperature level for the purpose of heating water, including all ancillary equipment such as fans, storage tanks, pumps, or controls necessary for the device to perform its function.

~~**SINGLE-PASS HEAT PUMP WATER HEATER** is a HPWH which the cold water passes through the heat pump(s) once and is heated to the intended storage temperature.~~

~~**MULTI-PASS HEAT PUMP WATER HEATER** is a HPWH which the cold water passes through the heat pump(s) multiple times, each time gaining a temperature increase, until the tank reaches the intended storage temperature.~~

INDIVIDUAL HEAT PUMP WATER HEATER is a HPWH which has all components, including fans, storage tanks, pumps, or controls necessary for the device to perform its function contained in a single factory-made assembly.

SPLIT-REFRIGERANT HEAT PUMP WATER HEATER is a HPWH which has a single outdoor section and one or more indoor sections connected to the outdoor section via a refrigerant circuit.

SPLIT-HYDRONIC HEAT PUMP WATER HEATER is a HPWH which has two distinct sections, one which has all refrigerant containing components and one or more storage sections, with all sections connected via a hydronic circuit.

SINGLE-PASS WATER HEATER is a water heater which the cold water passes through once and is heated to the intended use temperature.

MULTI-PASS WATER HEATER is a water heater which the cold water passes through multiple times, each time gaining a temperature increase, until the storage tank reaches the intended storage temperature.

NET FREE AREA is the total unobstructed area of the air gaps between louver and grille slats in a vent through which air can pass. The narrowest distance between two slats, perpendicular to the surface of both slats is the air gap height. The narrowest width of the gap is the air gap width. The net free area is the air gap height multiplied by the air gap width multiplied by the total number of air gaps between slats in the vent.

DOMESTIC HOT WATER SYSTEM APPURTENANCE are all elements that are in series in a domestic hot water distribution system, including fittings (elbows, tees, flanges, etc), pumps, valves (isolation, mixing, balancing, check, etc.), pipe supports and hangers, strainers, hose bibs, coil u-bends, meters, sensors, heat exchangers and air separators.

SECTION 110.3 – MANDATORY REQUIREMENTS FOR SERVICE WATER-HEATING SYSTEMS AND EQUIPMENT

Section 110.3(c) – Installation: Recommends new subsection as follows:

7. Heat pump water heaters. Consumer integrated heat pump water heater (HPWH) installation shall meet the following requirements.
 - A. Outdoor Design Conditions. Consumer integrated HPWHs with compressor cutout temperatures above the Winter Median of Extremes temperature for the closest location listed in Table 2-3 from Reference Joint Appendix JA2 may use outdoor air as the inlet air source if equipped with a backup heat source that engages when the compressor is unable to provide sufficient heat for domestic hot water.
 - B. Ventilation Method. Air for ventilation of consumer integrated heat pump water heaters (HPWHs) shall be obtained by application of one of methods in subsections 1 through 4. Spaces joined to the installation space via the applied ventilation method (the ventilation space) shall have a minimum volume of 100 cu. ft. per kBtu of total compressor capacity for all HPWHs in the installation space. Only rooms or spaces directly communicating with the installation space or the ventilation space through openings that cannot be closed using doors or other movable barriers shall be considered part of the volume of the installation space or ventilation space.
 1. Installed without ducts in a space with a minimum volume equal to the larger of 100 cu. ft. per kBtu/hr of total compressor capacity for all individual HPWHs in the space or the minimum installation space volume provided by the manufacturer for this method.
 2. Installed without ducts in a space smaller than required by subsection 1 above, according to the following requirements:
 - i. Minimum volume of the installation space shall be equal to the larger of 20 cu. ft. per kBtu/hr of compressor capacity for all individual HPWHs in the space or the minimum installation space volume provided by the manufacturer for this method; and
 - ii. Installation space shall be vented to a communicating space in the same pressure boundary via permanent openings with the minimum total net free area equal to the larger of 125 sq.

in. plus 25 sq. in. per kBtu/hr of compressor capacity for all individual HPWHs in the space or the minimum net free area provided by the manufacturer for this method, and that meet the following requirements:

- a. Fully louvered doors with fixed louvers consisting of a single layer of fixed flat slats; or
 - b. Two permanent fixed openings, consisting of a single layer of fixed flat slat louvers or grilles, one commencing within 12 inches from the top of the enclosure and one commencing within 12 inches from the bottom of the enclosure.
3. Installed with ducts in any size space, according to the following requirements:
- i. All ducts shall be sealed at all joints using mastic.
 - ii. All wall, floor, and ceiling penetrations are sealed using caulk or spray foam to join the exterior surface of the duct or duct insulation to the penetrated assembly; and
 - iii. Exhaust air ducts and all ducts which cross pressure boundaries shall be insulated to a minimum insulation level of R-6.
 - iv. If only makeup air is ducted, installation space shall include fixed flat slat louvers or grilles in the bottom half of the room, and/or a door undercut with a minimum total free area equal to the hydraulic diameter of the duct.
 - v. If only exhaust air is ducted, installation space shall include fixed flat slat louvers, grilles, and/or a door undercut with a minimum total net free area equal to the larger of 20 sq. in. or the minimum net free area provided by the manufacturer for this method.
 - vi. If makeup and exhaust ducts both terminate within the same pressure boundary, airflow from termination points shall be diverted away from each other.
4. Installed using method for ventilation certified by the manufacturer. A letter from the manufacturer providing this certification shall be included with plans submitted to the enforcement agency for approval.

SECTION 160.4 – MANDATORY REQUIREMENTS FOR WATER HEATING SYSTEMS

Moved to Section 160.9:

~~(a) Systems using gas or propane water heaters to serve individual dwelling units shall include the following components:~~

~~1. A dedicated 125 volt, 20 amp electrical receptacle that is connected to the electric panel with a 120/240 volt 3 conductor, 10 AWG copper branch circuit, within 3 feet from the water heater and accessible to the water heater with no obstructions. In addition, all of the following:~~

~~A. Both ends of the unused conductor shall be labeled with the word “spare” and be electrically isolated; and~~

~~B. A reserved single pole circuit breaker space in the electrical panel adjacent to the circuit breaker for the branch circuit in A above and labeled with the words “Future 240V Use”; and~~

~~2. A Category III or IV vent, or a Type B vent with straight pipe between the outside termination and the space where the water heater is installed; and~~

~~3. A condensate drain that is no more than 2 inches higher than the base of the installed water heater, and allows natural draining without pump assistance; and~~

~~4. A gas supply line with a capacity of at least 200,000 Btu/hr.~~

(f) Insulation for piping and tanks

1. All piping for multifamily domestic hot water systems shall be insulated to meet the requirements of Table 160.4-A.

TABLE 160.4-A PIPE INSULATION THICKNESS – Multifamily Domestic Hot Water

Fluid Operating Temperature Range (°F)	Insulation Conductivity		Nominal Pipe Diameter (in inches)					
	Conductivity (in Btu-in/h-ft ² -°F)	Mean Rating Temperature (°F)	< 1	1 to <1.5	1.5 to < 4	4 to < 8	8 and larger	
Multifamily Domestic Hot Water Systems			Minimum Pipe Insulation Required (Thickness in inches or R-value)					
105-140 ¹	0.22-0.28	100	Inches	1.0	1.5	2.0	2.0	2.0
			R-value	R 7.7	R 12.5	R 16	R 12.5	R 11

Footnote to TABLE 160.4-A:

1. Multifamily and hotel/motel domestic hot water systems with water temperature above 140°F shall use the row in Table 120.3-A for the applicable water temperature.

(g) General requirements. The piping conditions listed below for space-cooling and space-heating systems with fluid normal operating temperatures listed in Table 120.3-A, shall have at least the amount of insulation specified in Subsection (i):

1. **Space cooling systems.** All refrigerant suction, chilled water, and brine fluid distribution systems. Fluid distribution systems include all elements that are in series with the fluid flow, such as pipes, pumps, valves, strainers, coil u-bends, and air separators, but not including elements that are not in series with the fluid flow, such as expansion tanks, fill lines, chemical feeders, and drains
2. **Space heating systems.** All refrigerant, steam, steam condensate and hot water fluid distribution systems. Fluid distribution systems include all elements that are in series with the fluid flow, such as pipes, pumps, valves, strainers, coil u-bends, and air separators, but not including elements that are not in series with the fluid flow, such as expansion tanks, fill lines, chemical feeders, and drains
3. **Service water-heating systems.**
 - A. The first 8 feet of inlet cold water piping from the storage tanks, including piping between a storage tank and a heat trap shall be insulated.
 - B. Insulation on the piping and appurtenances shall be continuous.
 - C. Pipe supports, hangers, and pipe clamps shall be attached on the outside of rigid pipe insulation to prevent thermal bridging.
 - D. All pipe insulation seams shall be sealed
 - E. Insulation for pipe elbows shall be mitered, preformed, or site fabricated with PVC covers
 - F. Insulation for tees shall be notched, preformed, or site fabricated with PVC covers.
 - G. Extended stem isolation valves shall be installed.
 - H. All plumbing appurtenances on hot water piping from a heating source to heating plant, at the heating plant, and distribution supply and return piping shall be insulated to meet the following requirements:
 - a. Where the outer diameter of the appurtenance is less than the outer diameter of the insulated pipe that it is attached to, the appurtenance shall be insulated flush with the insulation surrounding the pipe.
 - b. Where the outer diameter of the appurtenance is larger than the outer diameter of the insulated pipe that it is attached to, the appurtenance shall be insulated with a minimum thickness of 1".
 - c. The insulation shall be removable and re-installable to ensure maintenance or replacement services can be completed.
 - d. The insulation shall not impede the functionality of the valve (e.g., opening and closing an isolation valve).

Hot water piping includes the pipe or tube and the fittings (elbows, tees, couplings, etc.)

Plumbing appurtenances include all elements that are in series with the hot water piping, such as flanges, pumps, valves (isolation, mixing, balancing, check, etc.), strainers, hose bibs, meters,

sensors, heat exchangers and air separators.

Exception to Section 160.4(a)2: Heat pump refrigerant vapor line shall be installed with a minimum of 0.5 inch thick or R-3.0 insulation for nonresidential buildings and 0.75 inch thick or R-6.0 insulation for residential buildings. No insulation is required on the refrigerant liquid line.

Exception 1 to Section 160.4(f)1: Factory-installed piping within space-conditioning equipment certified under Section 110.1 or 110.2.

Exception 2 to Section 160.4(f)1: Piping that penetrates framing members shall not be required to have pipe insulation for the distance of the framing penetration. Piping that penetrates metal framing shall use grommets, plugs, wrapping or other insulating material to ensure that no contact is made with the metal framing. Insulation shall abut securely against all framing members.

Exception 3 to Section 160.4(f)1: Piping installed in interior or exterior walls shall not be required to have pipe insulation if all of the requirements are met for compliance with quality insulation installation (QII) as specified in Reference Residential Appendix RA3.5.

Exception 4 to Section 160.4(f)1: Piping surrounded with a minimum of 1 inch of wall insulation, 2 inches of crawl space insulation or 4 inches of attic insulation shall not be required to have pipe insulation.

(h) Insulation protection. Pipe insulation shall be protected from damage due to sunlight, moisture, equipment maintenance and wind. Protection shall, at minimum, include the following:

1. Pipe insulation exposed to weather shall be protected by a cover suitable for outdoor service. The cover shall be water retardant and provides shielding from solar radiation that can cause degradation of the material. Adhesive tape shall not be used to provide this protection.
2. Pipe insulation covering chilled water piping and refrigerant suction piping located outside the conditioned space shall include, or be protected by, a Class I or Class II vapor retarder. All penetrations and joints shall be sealed.
3. Pipe insulation buried below grade must be installed in a water proof and noncrushable casing or sleeve.

(i) Insulation thickness

1. For insulation with a conductivity in the range shown in Table 120.3-A for the applicable fluid temperature range, the insulation shall have the applicable minimum thickness or R-value shown in Table 120.3-A.
2. For insulation with a conductivity outside the range shown in Table 120.3-A for the applicable fluid temperature range, the insulation shall have a minimum R-value shown in Table 120.3-A or thickness as calculated:

MINIMUM INSULATION THICKNESS EQUATION

$$T = PR \left[\left(1 + \frac{t}{PR} \right)^{\frac{K}{k}} - 1 \right]$$

WHERE:

T = insulation thickness for material with conductivity K, inches.

PR = actual outside radius, inches.

t = Insulation thickness from Table 160.4-A, inches.

K = Conductivity of alternate material at the mean rating temperature indicated in Table 160.4-A for the

applicable fluid temperature range, in Btu-inch per hour per square foot per °F.

k = The lower value of the conductivity range listed in Table 160.4-A for the applicable fluid temperature

range, Btu-inch per hour per square foot per °F.

(j) Master Mixing Valves. Centralized water heating plants with recirculation system(s) serving multiple dwelling units shall install a mechanical or digital thermostatic master mixing valve on each distribution loop that conforms to the American Society of Sanitation Engineers (ASSE) 1017-2009 standard, *Performance Requirements for Temperature Actuated Mixing Valves for Hot Water Distribution Systems*.

1. The master mixing valve shall be installed on the heating plant hot water supply outlet header leading to the recirculation loop.
2. The master mixing valve shall be installed and commissioned in accordance with manufacturer's instructions and applicable reference appendix.
3. The plumbing plans shall provide MMV installation details and specifications indicating water mixing parameters, if this exceeds the mixing capability of the specified MMV, the designer shall provide valve commissioning instructions to prevent temperature creep.

SECTION 160.9 – MANDATORY REQUIREMENTS FOR ELECTRIC READY BUILDINGS

For the electric ready equipment in 160.9 a - e, the conductors or raceway and any intervening subpanels, panelboards, switchboards, and busbars shall be sized to meet the future electric power requirements, at the service voltage to the point at which the conductors serving the building connect to the utility distribution system, as specified below. The building service conduit shall also be sized to meet the future electric power requirements. The capacity requirements may be adjusted for demand factors in accordance with the California Electric Code. Gas flow rates shall be determined in accordance with the California Plumbing Code. Capacity shall be one of the following:

(a) Heat Pump Space Heater Ready. Systems using gas or propane furnaces to serve individual [dwelling](#) units shall include the following:

1. A dedicated 240 volt branch circuit wiring shall be installed within 3 feet from the furnace and [accessible](#) to the furnace with no obstructions. The branch circuit conductors shall be rated at 30 amps minimum. The blank cover shall be identified as “240V ready”. All electrical components shall be installed in accordance with the *California Electrical Code*.
2. The main electrical [service](#) panel shall have a reserved space to allow for the installation of a double pole circuit breaker for a future [heat pump](#) space heater installation. The reserved space shall be permanently marked as “For Future 240V use”.

(b) Electric Cooktop Ready. Systems using gas or propane cooktops to serve individual [dwelling](#) units shall include the following:

1. A dedicated 240 volt branch circuit wiring shall be installed within 3 feet from the cooktop and [accessible](#) to the cooktop with no obstructions. The branch circuit conductors shall be rated at 50 amps minimum. The blank cover shall be identified as “240V ready”. All electrical components shall be installed in accordance with the *California Electrical Code*.
2. The main electrical [service](#) panel shall have a reserved space to allow for the installation of a double pole circuit breaker for a future electric cooktop installation. The reserved space shall be permanently marked as “For Futl 240V use”.

(c) Electric Clothes Dryer Ready. Clothes dryer locations with gas or propane plumbing shall include the following:

1. Systems serving individual dwelling units shall include:
 - A. A dedicated 240 volt branch circuit wiring shall be installed within 3 feet from the clothes dryer location and [accessible](#) to the clothes dryer location with no obstructions. The branch circuit conductors shall be rated at 30 amps minimum. The blank cover shall be identified as “240V ready”. All electrical components shall be installed in accordance with the *California Electrical Code*.
 - B. The main electrical [service](#) panel shall have a reserved space to allow for the installation of a double pole circuit breaker for a future electric clothes dryer installation. The reserved space shall be permanently marked as “For Future 240V use”.

2. Systems in common use areas shall include:

A. Conductors or raceway shall be installed with termination points at the main electrical panel, via subpanels panels if applicable, to a location no more than 3 feet from each gas outlet or a designated location of future electric replacement equipment. Both ends of the conductors or raceway shall be labelled "Future 240V Use." ~~The conductors or raceway and any intervening subpanels, panelboards, switchboards, and busbars shall be sized to meet the future electric power requirements, at the service voltage to the point at which the conductors serving the building connect to the utility distribution system, as specified below. The capacity requirements may be adjusted for demand factors in accordance with the California Electric Code. Gas flow rates shall be determined in accordance with the California Plumbing Code. Capacity shall be one of the following:~~

i. 24 amps at 208/240 volts per clothes dryer;

ii. 2.6 kVA for each 10,000 Btu per hour of rated gas input or gas capacity; or

30.iii. The electrical power required to provide equivalent functionality of the gas-powered equipment as calculated and documented by the responsible person associated with the project.

(d) Systems using gas or propane water heaters to serve individual dwelling units shall include the following components:

1. A dedicated 125 volt, 20 amp electrical receptacle that is connected to the electric panel with a 120/240 volt 3 conductor, copper branch **circuit rated to 30 amps**, within 3 feet from the water heater and accessible to the water heater with no obstructions. In addition, all of the following:

A. Both ends of the unused conductor shall be labeled with the word "spare" and be electrically isolated; and

B. A reserved single pole circuit breaker space in the electrical panel adjacent to the circuit breaker for the branch circuit in A above and labeled with the words "Future 240V Use"; and

C. Raceway and/or conductors and any intervening subpanels, panelboards, switchboards, disconnects, and busbars from the main electrical panel or subpanel up to and including the meter panel shall be sized to meet the future electrical power requirements of the heat pump water heater

- D. Conduit from utility transformer to meter panel or similar conduit or other electrical equipment supplied by the owner to make the connection with the utility power on the property shall be sized to meet the future electrical power requirements of the heat pump water heater

- 2. A Category III or IV vent, or a Type B vent with straight pipe between the outside termination and the space where the water heater is installed; and
- 3. A condensate drain that is no more than 2 inches higher than the base of the installed water heater, and allows natural draining without pump assistance, and
- 4. A gas supply line with a capacity of at least 200,000 Btu/hr.
- 1. The construction drawings shall indicate the location of the future heat pump water heater. The reserved location shall have minimum interior dimensions of 39"x39"x96"
- 2. A ventilation method meeting one of the following:
 - 1. Installed in space with minimum volume of 450 cu. ft., or
 - 2. Installed in a smaller space vented to a space 450 cu. ft. or larger via louvers with a total of 250 sq. in. net free area
 - 3. Installed with two 8" capped ducts, venting to exterior

(e) Central Heat Pump Water Heater Electric Ready. Water heating systems using gas or propane to serve multiple dwelling units shall comply with the requirements of 160.9(e)1, and 2 or 3-:

- 1. Input gas or propane.
 - A. The gas or propane water heating system input gas or propane capacity shall be the sum of the input gas or propane capacity of all water heating devices associated with each gas or propane water heating system.
- 2. System shall be sized with prescribed sizing factors, or
 - a. Physical space reserved.
 - A. Construction drawings shall indicate the location of the future heat pump water heating equipment. Physical space shall be reserved for future heat pump water heating equipment in accordance with 160.9(d)2B and 160.9(d)2C. The physical space reserved may overlap with the gas or propane water heating system.
 - B. Heat pump.

- C. The minimum physical space reserved shall be 3.6 square feet per input 10,000 Btu/HR. of the gas or propane water heating system
- D. The minimum linear dimension of physical space reserved shall be 48 linear inches minimum for systems 125,000 BTU.HR or less, or 84" linear inches minimum for systems greater than 125,000 BTU.HR
- b. Tanks.
 - A. The minimum physical space reserved for the storage and temperature maintenance tanks shall be 4.4 square feet per input 10,000 Btu/HR. of the gas or propane water heating system
- c. Ventilation.
 - A. Physical space reserved for the heat pump shall be located outside, or
 - B. A pathway shall be reserved for future routing of supply and exhaust air via ductwork or louvers from the reserved heat pump location to an appropriate outdoor location
 - i. Penetrations through the building envelope for louvers and ducts shall be installed and capped for future use
 - ii. Duct and louver penetrations shall be sized for 420 CFM per input 10,000 Btu/HR of the gas or propane water heating system
- d. Condensate drainage.
 - A. Condensate drainage shall be sized to collect and discharge condensate from 0.7 tons of refrigeration capacity per input 10,000 Btu/HR. of the gas or propane water heating system, in accordance with the California Plumbing Code.
 - B. Condensate drainage piping shall be installed from within 3 feet of the reserved heat pump location to an approved discharge location
 - i. Condensate drainage piping is not required within 3 feet of the reserved heat pump location if the reserved heat pump location is outdoors and the construction drawings indicate that the heat pump condensate drainage will drain to an adequately sized roof drain, or

- ii. an adequately sized floor sink must be installed in the same room as the gas or propane water heating equipment

e. Electrical

A. The following electrical components shall be sized to meet the future electrical power requirements of the heat pump and temperature maintenance tanks of the central heat pump water heater. The electrical demand shall be calculated to be 1.1 kVA per 10,000 Btu/hr of input fuel capacity for the heat pump and 1.0 kVA per 10,000 Btu/hr. Of input fuel capacity for temperature maintenance tanks.

1. i. Raceway and/or conduit for the heat pump shall be installed, with termination points at the main electrical panel and through subpanels if applicable, to a location no more than 3 feet from the reserved heat pump location. Both ends of the conduit or raceway shall be labelled appropriately to indicate "Sized and Reserved for Future Electric Water Heating."
1. ii. Raceway and/or conduit for the temperature maintenance tank shall be installed, with termination points at the main electrical panel, via subpanels if applicable, to a location no more than 3 feet from the reserved temperature maintenance tank location.
1. iii. Raceway and/or conductors and any intervening subpanels, panelboards, switchboards, disconnects, and busbars from the main electrical panel or subpanel up to and including the meter panel
1. iv. Conduit from utility transformer to meter panel or similar conduit or other electrical equipment supplied by the owner to make the connection with the utility power on the property.

3. System shall be sized by a licensed engineer and meet the following: Fully Engineered system

2. Physical space reserved.

- A. Construction drawings shall indicate the location of the future heat pump water heating equipment. Physical space shall be reserved for future heat pump water heating equipment in accordance with 160.9(d)2B and 160.9(d)2C. The physical space reserved may overlap with the gas or propane water heating system.

1. Heat pump.
2. Tanks.
3. Ventilation.
4. Condensate drainage.
 - A. Condensate drainage piping shall be installed from within 3 feet of the reserved heat pump location to an approved discharge location
5. Electrical
 - A. The following electrical components shall be sized to meet the future electrical power requirements of the heat pump and temperature maintenance tanks of the central heat pump water heater.
 - i. Raceway and/or conduit for the heat pump shall be installed, with termination points at the main electrical panel and through subpanels if applicable, to a location no more than 3 feet from the reserved heat pump location. Both ends of the conduit or raceway shall be labelled appropriately to indicate "Sized and Reserved for Future Electric Water Heating."
 - ii. Raceway and/or conduit for the temperature maintenance tank shall be installed, with termination points at the main electrical panel, via subpanels if applicable, to a location no more than 3 feet from the reserved temperature maintenance tank location.
 - iii. Raceway and/or conductors and any intervening subpanels, panelboards, switchboards, disconnects, and busbars from the main electrical panel or subpanel up to and including the meter panel
 - iv. Conduit from utility transformer to meter panel or similar conduit or other electrical equipment supplied by the owner to make the connection with the utility power on the property.

NOTE: Authority: Sections 25213, 25218, 25218.5, 25402 and 25402.1, Public Resources Code.
Reference: Sections 25007, 25008, 25218.5, 25310, 25402, 25402.1, 25402.4, 25402.5, 25402.8, and 25943, Public Resources Code.

Section 170.2 PERSCRIPTIVE APPROACH

Section 170.2(d) Water Heating Systems. Water-heating systems shall meet the requirements of either 1, 2, 3 or 4.

For hot water piping serving individual and multiple dwelling units, heating plant and recirculation system piping insulation quality shall be field verified and shall meet the criteria specified in Reference Appendix RA36.10. For hot water distribution piping serving individual and multiple dwelling units, verify pipe sizing is in accordance to CPC Appendix M.

~~For recirculation distribution systems serving individual dwelling units, only Demand Recirculation Systems with manual on/off control as specified in the Reference Appendix RA4.4.9 shall be used.~~ Recirculation systems serving multiple dwelling units shall meet the requirements in Section 110.3(c)2 and 110.3(c)5-4, and shall be capable of automatically controlling the recirculation pump operation based on measurement of hot water demand and hot water return temperature.

1. For systems serving individual dwelling units, the water heating system shall meet the requirement of either A, B, C, or shall meet the performance compliance requirements of Section 170.1:
 - A. A single 240 volt heat pump water heater. In addition, meet the following:
 - i. A compact hot water distribution system as specified in the Reference Appendix RA4.4.6. in climate 1 and 16; and
 - ii. A drain water heat recovery system that is field verified as specified in the Reference Appendix RA3.6.9 in Climate Zone 16
 - iii. installation shall meet requirements specified in Section 110.3 (c)
 - B. A single heat pump water heater that meets the requirements of NEEA Advanced Water Heater Specification Tier 3 or higher. In addition, for Climate Zones 16, a drain water heat recovery system that is field verified as specified in the Reference Appendix RA3.6.9.
 - C. A gas or propane instantaneous water heater with an input of 200,000 Btu per hour or less and no storage tank.
2. For heat pump water-heating systems serving multiple dwelling units, the water heating system shall be installed according to the manufacturer design and installation guidelines and meet A or B, or shall meet the performance compliance requirements of Section 170.1: the following requirements:
 - A. A system meeting the following requirements:
 - i. Use single-pass primary heat pump water heater. The hot water return from the recirculation loop shall connect to a recirculation loop tank and shall not directly connect to the primary heat pump water heater inlet or the primary thermal storage tanks.
 - ii. The fuel source for the recirculation loop tank shall be electricity if auxiliary heating is needed. The recirculation loop heater shall be capable of multi-pass water heating operation.

- ~~iii.~~ For systems with single pass primary heat pump water heater, the primary thermal storage tanks shall be piped in series if multiple tanks are used. ~~For systems with multi-pass primary heat pump water heater, the primary thermal storage tanks shall be piped in parallel if multiple tanks are used.~~
- iv. The primary storage tank temperature setpoint shall be at least 135°F.
- v. The recirculation loop tank temperature setpoint shall be at least 10°F lower than the primary thermal storage tank temperature setpoint such that hot water from the recirculation loop tank is used for the temperature maintenance load before engaging the recirculation loop tank heater.
- vi. The minimum heat pump water heater compressor cut-off temperature shall be equal to or lower than 40°F ambient air temperature.
- vii. A recirculation system.
- viii. Design documentation shall be provided in accordance with JA14.4.

EXCEPTION to Section 170.2(d)2GA. vii: Buildings with eight or fewer dwelling units.

B. ~~A system that meets requirement of NEEA Advanced Water Heating Specification for commercial HPWH system Tier 3 or higher.~~

3. For gas or propane systems serving multiple dwelling units, a central water-heating system that includes the following components shall be installed:

A. For Climate Zones 1 through 9, gas service water-heating systems with a total installed gas water-heating input capacity of 1 MMBtu/h or greater shall have gas service water-heating equipment with a minimum thermal efficiency of 90 percent. Multiple units are allowed to meet this requirement with an input capacity-weighted average of at least 90 percent.

EXCEPTION 1 to Section 170.2(d)3A: Individual gas water heaters with input capacity at or below 100,000 Btu/h shall not be included in the calculations of the total system input or total system efficiency.

EXCEPTION 2 TO Section 170.2(d)3A: If 25 percent of the annual water-heating requirement is provided by site-solar energy or site-recovered energy.

B. A recirculation system.

EXCEPTION to Section 170.2(d)3B: Buildings with eight or fewer dwelling units.

C. A solar water-heating system meeting the installation criteria specified in Reference Residential Appendix RA4 and with a minimum solar savings fraction of either i or ii below:

- i. A minimum solar savings fraction of 0.20 in Climate Zones 1 through 9 or a minimum solar savings fraction of 0.35 in Climate Zones 10 through 16; or

- ii. A minimum solar savings fraction of 0.15 in Climate Zones 1 through 9 or a minimum solar savings fraction of 0.30 in Climate Zones 10 through 16. In addition, a drain water heat recovery system that is field verified as specified in the Reference Appendix RA3.6.9.
- a) A water-heating system serving multiple dwelling units determined by the Executive Director to use no more energy than the one specified in subsection 1, 2, or 3 above.

SUBCHAPTER 12 **MULTIFAMILY BUILDINGS - ADDITIONS,** **ALTERATIONS, AND REPAIRS TO EXISTING** **MULTIFAMILY BUILDINGS**

SECTION 180.1 – ADDITIONS

Additions to existing multifamily buildings shall meet the applicable requirements of Sections 110.0 through 110.9, Sections 160.0, 160.1, 160.2(c) and (d), 160.3 through 160.7, and either Section 180.1(a) or 180.1(b).

~~Exception 1 to Section 180.1: Additions 1,000 square feet or less are exempt from the requirement to provide dwelling unit mechanical ventilation airflow as specified by Section 180.1(a) or 180.1(b).~~

EXCEPTION 2 to Section 180.1: Additions of 300 square feet or less are exempt from the roofing product requirements of Section 170.2(a)1A.

EXCEPTION 3 to Section 180.1: Existing inaccessible piping shall not require insulation as defined under Section 160.4(f)2Aiii.

EXCEPTION 4 to Section 180.1: Space-Conditioning System. When heating or cooling will be extended to an addition from the existing system(s), the existing heating and cooling equipment need not comply with Part 6. The heating system capacity must be adequate to meet the minimum requirements of CBC Section 1204.1.

EXCEPTION 5 to Section 180.1: Space-Conditioning System Ducts. When any length of ducts are extended from an existing duct system to serve the addition, the existing duct system and the extended ducts shall meet the applicable requirements specified in Section 180.1(b)2ai and 180.1(b)2aii.

EXCEPTION 6 to Section 150.2(a)180.1: Photovoltaic and battery storage systems, as specified in Section 170.2(f) through 170.2(h), are not required for additions.

EXCEPTION 7 to Section 180.1: Dwelling Unit Space Heating System. New or replacement space heating systems serving an addition may be a pump or gas heating system.

(30) (a) Mandatory Requirements. Added components in a multifamily building shall meet the minimum requirements in this Section.

1. **Domestic Hot Water Recirculation System.** Anytime additions to the distribution system or water heater in a central water heating system with continuous recirculation is made, the contractor shall verify the existence of, or install, a thermostatic or digital master mixing valve on each distribution loop that conforms to the American Society of Sanitation Engineers (ASSE) 1017-2009_standard. The master mixing valve shall be installed and commissioned in accordance with manufacturer's instructions and applicable Reference Appendix.

2. **Domestic Hot Water Riser Recirculation System** Any time an addition is made to a central water heating system with two or more risers or zones, which has no balancing valves or would require manually adjusted balancing valves to be manually rebalanced or replaced, the contractor shall verify the existence of, or install:

A. **Thermostatic balancing valves.** In replacement of manual balancing valves in most multifamily applications for each riser or zone on a recirculation system.

B. **Pressure independent balancing valves.** In replacement of manual balancing valves to serve at-risk occupants for each riser or zone on a recirculation system.

C. **Variable speed pump.** In replacement of existing single speed or three speed recirculation pump if pressure independent or thermostatic balancing valves are installed.

(b) **Prescriptive approach.** The envelope and lighting of the addition; any newly installed space-conditioning or ventilation system, electrical power distribution system, or water-heating system; any addition to an outdoor lighting system; and any new sign installed in conjunction with an indoor or outdoor addition shall meet the applicable requirements of Sections 110.0 through 110.12, and 160.0, 160.1, 160.2(c) and (d), 160.3 through 170.2.

1. Envelope.

A. Additions that are greater than 700 square feet shall meet the requirements of Section 170.2(a), with the following modifications:

i. Framed Walls Extension. Extensions of existing wood-framed walls may retain the dimensions of the existing walls and shall install cavity insulation of R-15 in a 2x4 framing and R-21 in a 2x6 framing.

ii. The maximum allowed fenestration area shall be the greater of 175 square feet or 20 per of the addition floor area.

30. iii. When existing siding of a wood-framed wall is not being removed or replaced, cavity insulation of R-15 in a 2x4 framing and R-21 in a 2x6 framing shall be installed and continuous insulation is not required.

iv. Additions that consist of the conversion of existing spaces from unconditioned to conditioned space shall not be required to perform the air sealing part of QII when the existing air barrier is not being removed or replaced.

B. Additions that are 700 square feet or less shall meet the requirements of Section 170.2(a), with the following modifications.

i. Roof and Ceiling insulation in a ventilated attic shall meet one of the following requirements:

a. In Climate Zones 1, 2, 4, and 8 through 16, achieve an overall assembly U-factor not exceeding 0.025. In wood framed assemblies, compliance with U-factors may be demonstrated by installing insulation with an R-value of R-38 or greater.

b. In Climate Zones 3, and 5 through 7, achieve an overall assembly U-factor not exceeding 0.031. In wood framed assemblies, compliance with U-factors may be demonstrated by installing insulation with an R-value of R-30 or greater.

ii. Radiant Barrier – For buildings three habitable stories or less, radiant barriers shall be installed in attics with exposed attic deck guides in Climate Zones 2-15.

30. iii. Extensions of existing wood-framed walls may retain the dimensions of the existing walls and shall install cavity insulation of R-15 in a 2x4 framing and R-21 in a 2x6 framing; and

iv. Fenestration products must meet the U-factor, RSGHC, and requirements of TABLE 180.2-B

30. v. Quality Insulation Installation (QII) requirements of Section 170.2(a)6 do not apply.

EXCEPTION 1 to Section 180.1(a)1B: Insulation in an enclosed rafter ceiling shall meet the requirements of Section 160.1(a).

EXCEPTION 2 to Section 180.1(a)1B: Additions that increase the area of the roof by 2,000 square feet or less are exempt from the solar ready requirements of Section 160.8.

2. Mechanical Ventilation for Indoor Air Quality. Additions to existing buildings shall comply with Section 160.2 subject to the requirements specified in subsections A and B below. When HERS field verification and diagnostic testing is required by Section 180.1(a)2, buildings with three habitable stories or less shall use the applicable procedures in the Residential Appendices, and buildings with four or more habitable stories shall use the applicable procedures in Nonresidential Appendices NA1 and NA2.

A. Whole-dwelling Unit Mechanical Ventilation.

i. Dwelling units that meet the conditions in subsections a or b below shall not be required to comply with the whole-dwelling unit ventilation airflow specified in Sections 160.2(b)2Aiv or 160.2(b)2Av.

a. Additions to an existing dwelling unit that increase the conditioned floor area of the existing dwelling unit by less than or equal to 1000 square feet.

b. Junior Accessory Dwelling Units (JADU) that are additions to an existing building.

ii. Additions to an existing dwelling unit that increase conditioned floor area by more than 1,000 square feet shall have mechanical ventilation airflow in accordance with Sections 160.2(b)2Aiv or 160.2(b)2Av, as applicable. The mechanical ventilation airflow

rate shall be based on the conditioned floor area of the entire dwelling unit comprised of the existing dwelling unit conditioned floor area plus the addition conditioned floor area.

iii. New dwelling units that are additions to an existing building shall have mechanical ventilation airflow provided in accordance with Sections 160.2(b)2Aiv or 160.2(b)2Av as applicable. The mechanical ventilation airflow rate shall be based on the conditioned floor area of the new dwelling unit.

B. Local Mechanical Exhaust. Additions to existing buildings shall comply with all applicable requirements specified in 160.2(b)2Avi and 160.2(b)2B.

3. Water Heater. When additional water heating equipment is installed to serve a dwelling unit as part of the addition, one of the following types of water heaters shall be installed:

A. A water-heating system that meets the requirements of Section 170.2(d); or

B. A water-heating system determined by the Executive Director to use no more energy than the one specified in Item A above.

(a) Mandatory Requirements. Added components in a multifamily building shall meet the minimum requirements in this Section.

3. **Domestic Hot Water Recirculation System.** Any time additions to the distribution system or water heater in a central water heating system is made, the contractor shall verify the existence of, or install, a thermostatic master mixing valve.

(b) Prescriptive approach

3. Hot Water Systems.

Altered or replacement water-heating systems or components serving individual [dwelling](#) units shall meet the applicable requirements below:

A. Pipe Insulation. For newly installed piping and existing [accessible](#) piping, the insulation requirements of Section [160.4\(f\)](#) shall be met.

B. Distribution System. For recirculation distribution system serving individual dwelling units, only Demand Recirculation Systems with manual on/off control as specified in the Reference Appendix [RA4.4.9](#) shall be installed.

C. Water heating system. The water heating system shall meet one of the following:

i. A natural gas or propane water-heating system; or

ii. A single [heat pump](#) water heater. The storage tank shall not be located outdoors and be placed on an incompressible, rigid insulated surface with a minimum thermal resistance of R-10. The water heater shall be installed with a communication interface that meets either the requirements of [110.12\(a\)](#) or has a [ANSI/C45-B](#) communication port; or

30.iii. A single heat pump water heater that meets the requirements of [NEEA Advanced Water Heater Specification](#) Tier 3 or higher; or

iv. If the existing water heater is an electric resistance water heater, consumer electric water heater.

30.v. A water-heating system determined by the Executive Director to use no more energy than the one specified in Section 180.2(b)3Ci through iii above; or if no natural gas is connected to the existing water heater location, a water-heating system determined by the executive director to use no more energy than the one specified in Section 180.2(b)3Civ above.

vi. Domestic Hot Water Riser Recirculation System. Any time a new hot water branch or fixture requiring hot water is added to a central water heating system with two or more risers or zones, the contractor shall verify the existence of, or install:

B. Thermostatic balancing valves set to 120 °F, or pressure independent control valves for which the construction documents document the flow rate set point at each valve and include calculations demonstrating that the flow set point results in temperatures not greater than 120 °F at the pressure independent control valve. and

C. Variable speed pump. In replacement of existing single speed or three speed recirculation pump if pressure independent or thermostatic balancing valves are installed.

(c) **Performance approach.** Performance calculations shall meet the requirements of Section 170.0 through 170.2(a), pursuant to the applicable requirements in Items 1, 2, and 3 below.

1. For additions alone. The addition complies if the addition alone meets the energy budgets as specified in Section 170.1.

2. Existing plus alteration plus addition. The standard design for existing plus alteration plus addition energy use is the combination of the existing building's unaltered components to remain; existing building altered components that are the more efficient, in TDV energy, of either the existing conditions or the requirements of Section 180.2(c); plus the proposed addition's energy use meeting the requirements of Section 180.1(a). The proposed design energy use is the combination of the existing building's unaltered components to remain and the altered components' energy features, plus the proposed energy features of the addition.

EXCEPTION to Section 180.1(b)2: Existing structures with a minimum R-11 insulation in framed walls showing compliance with Section 180.1(b) are exempt from showing compliance with Section 160.1(b).

3. Mechanical Ventilation for Indoor Air Quality. Additions to existing buildings shall comply with Section 160.1(b)2 subject to the requirements specified in subsections A and B below. When HERS field verification and diagnostic testing is required by Section 180.1(b)3, buildings with three habitable stories or less shall use the applicable procedures in the Residential Appendices, and buildings with four or more habitable stories shall use the applicable procedures in Nonresidential Appendices NA1 and NA2.

A. Whole-dwelling Unit Mechanical Ventilation.

i. Dwelling units that meet the conditions in subsections a or b below shall not be required to comply with the whole-dwelling unit ventilation airflow specified in Sections 160.2(b)2Aiv or 160.2(b)2Av.

- a. Additions to an existing dwelling unit that increase the conditioned floor area of the existing dwelling unit by less than or equal to 1000 square feet.
- b. Junior Accessory Dwelling Units (JADU) that are additions to an existing building.
 - ii. Additions to an existing dwelling unit that increase the conditioned floor area of the existing dwelling unit by more than 1,000 square feet shall have mechanical ventilation airflow in accordance with Section 160.2(b)2Aiv or 160.2(b)2Av as applicable. The mechanical ventilation airflow rate shall be based on the conditioned floor area of the entire dwelling unit comprised of the existing dwelling unit conditioned floor area plus the addition conditioned floor area.
 - iii. New dwelling units that are additions to an existing building shall have mechanical ventilation airflow provided in accordance with Section 160.2(b)2Aiv or 160.2(b)2Av as applicable. The mechanical ventilation airflow rate shall be based on the conditioned floor area of the new dwelling unit.

30. B. Local Mechanical Exhaust. Additions to existing buildings shall comply with all applicable requirements specified in 160.2(b)2Aiv and 160.2(b)2B.

NOTE: Authority: Sections 25213, 25218, 25218.5, 25402 and 25402.1, Public Resources Code. Reference: Sections 25007, 25008, 25218.5, 25310, 25402, 25402.1, 25402.4, 25402.5, 25402.nd

(30) 25943, Public Resources Code.

(b) Prescriptive approach. The
SECTION 180.2 – ALTERATIONS

Alterations to components of existing multifamily buildings, including alterations made in conjunction with a change in building occupancy to a multifamily occupancy shall meet item (a), and either Item (b) or (c) below:

EXCEPTION 1 to Section 180.2: When heating, cooling or service water heating for an alteration are provided by expanding existing systems, the existing systems and equipment need not comply with Sections 110.0 through 110.10, 160.0 through 160.7, and Section 170.2(c) or 170.2(d).

EXCEPTION 2 to Section 180.2: When existing heating, cooling or service water heating systems or components are moved within a building, the existing systems or components need not comply with Sections 110.0 through 110.10, 160.0 through 160.7, and Section 170.2(c) or 170.2(d).

EXCEPTION 3 to Section 180.2: Where an existing system with electric reheat is expanded when adding variable air volume (VAV) boxes to serve an alteration, total electric reheat capacity may be expanded not to exceed 20 percent of the existing installed electric capacity in any one permit and the system need not comply Section 170.2(b)4E. Additional electric reheat capacity in excess of 20 percent may be added subject to the requirements of the Section 170.2(b)4E.

EXCEPTION 4 to Section 180.2: The requirements of Section 160.3(a)2H shall not apply to alterations of space- conditioning systems or components.

b. **Mandatory Requirements.** Altered components in a multifamily building shall meet the minimum requirements in this Section.

1. **Roof/Ceiling Insulation.** The opaque portions of the roof/ceiling that separate conditioned spaces from unconditioned spaces or ambient air shall meet the requirements of Section 180.2(b)1B.

2. **Wall Insulation.** For the altered opaque portion of walls separating conditioned spaces from unconditioned spaces or ambient air shall meet the applicable requirements of Items A through D below:

- A. **Metal Building.** A minimum of R-13 insulation between framing members, or the area-weighted average U-factor of the wall assembly shall not exceed U-0.113.
- B. **Metal Framed.** A minimum of R-13 insulation between framing members, or the area-weighted average U-factor of the wall assembly shall not exceed U-0.217.
- C. **Wood Framed and Others.** A minimum of R-11 insulation between framing members, or the area-weighted average U-factor of the wall assembly shall not exceed U-0.110.
- D. **Spandrel Panels and Curtain Walls.** A minimum of R-4, or the area-weighted average U-factor of the wall assembly shall not exceed U-0.280.

EXCEPTION to Section 180.2(a)2: Light and heavy mass walls.

3. **Floor Insulation.** For the altered portion of raised floors that separate conditioned spaces from unconditioned spaces or ambient air shall meet the applicable requirements of Items A through B below:

- A. **Raised Framed Floors.** A minimum of R-11 insulation between framing members, or the area-weighted average U-factor of the floor assembly shall not exceed the U-factor of U-0.071.
- B. **Raised Mass Floors.** A minimum of R-6 insulation, or the area-weighted average U-factor of the floor assembly shall not exceed the U-factor of U-0.111.

4. **Domestic Hot Water Recirculation System.**

- A. **Master Mixing Valves.** Anytime alterations to the distribution system or water heater in a central water heating system with continuous recirculation is made, the contractor shall verify the existence of, or install, a thermostatic master mixing valve on each distribution loop that conforms to the American Society of Sanitation Engineers (ASSE) 1017-2009 standard. The master mixing valve shall be installed and commissioned in accordance with manufacturer's instructions and applicable Reference Appendix.
- B. **Any time the hot water distribution system piping or water heater in a central water heating system serving two or more risers or zones is altered, the contractor shall verify the existence of, or install:**
 - i. **Thermostatic balancing valves set to 120 °F, or pressure independent control valves for which the construction documents document the flow rate set point at each valve and include calculations demonstrating that the flow set point results in temperatures not greater than 120 °F at the pressure independent control valve.**
 - ii. **Variable speed pump. In replacement of existing single speed or three speed recirculation pump if pressure independent or thermostatic balancing valves are installed.**

c. **Prescriptive approach.** The altered component and any newly installed equipment serving the alteration shall meet the applicable requirements of Sections 110.0 through 110.9 and all applicable requirements of Section 160.0, 160.1, 160.2(c) and (d), 160.3(a) through 160.3(b)5J, 160-3(b)6, 160.3(c), and 160.5; and

1. **Envelope—**

- A. **Roofing Products Roof Alterations.** Existing roofs being replaced, recovered or recoated, of a multifamily building shall meet the requirements of Section 110.8(i). Roofs with more than 50 percent of the roof area or more than 2,000 square feet of roof, whichever is less, being altered the requirements of i through ii below apply:

EXCEPTION to Section 180.2(b)1A: Roof area covered by building integrated photovoltaic panels and building integrated solar thermal panels are not

required to meet the minimum requirements for solar reflectance, thermal emittance, or SR.

i. Low-sloped roofs in Climate Zones 2, 4, and 6 through 15 shall have a minimum aged solar reflectance of 0.63 and a minimum thermal emittance of 0.75, or a minimum SRI of 6475.

EXCEPTION 1 to Section 180.2(b)1Ai: ~~An~~ The aged solar reflectance requirement less than 0.63 is allowed for low-sloped roofs provided the maximum roof/ceiling U-factor can be met by using insulation at the roof deck specified in TABLE 180.2-A is not exceeded.

1. Table 180.2-A Roof/Ceiling Insulation Tradeoff for Low-Sloped Aged Solar Reflectance

<u>Minimum Aged Solar Reflectance</u>	<u>Roof Deck Continuous Insulation R-value (Climate Zones 6-7)</u>	<u>Roof Deck Continuous Insulation R-value (Climate Zones 2, 4, 8-15)</u>
<u>0.60</u>	<u>2</u>	<u>16</u>
<u>0.55</u>	<u>4</u>	<u>18</u>
<u>0.50</u>	<u>6</u>	<u>20</u>
<u>0.45</u>	<u>8</u>	<u>22</u>
<u>No requirement</u>	<u>10</u>	<u>24</u>

EXCEPTION 2 to Section 180.2(b)1Ai: Roof constructions with a weight of at least 25 lb/ft² are not required to meet the minimum requirements for solar reflectance, thermal emittance, or SRI.

ii. Steep-sloped roofs in Climate Zones 4 and 8 through 15 shall have a minimum aged solar reflectance of 0.20 and a minimum thermal emittance of 0.75, or a minimum SRI of 16.

EXCEPTION 1 TO 180.2(b)1Aii ~~150.2(b)1Ji~~: The following shall be considered equivalent to Subsection ii:

- a. Buildings with ceiling assemblies with a U-factor lower than or equal to 0.025 or that are insulated with at least R-38 ceiling insulation in an attic; or
- b. Buildings with a radiant barrier in the attic, where the radiant barrier is not installed directly above spaced sheathinmeeting the requirements of Section 450.1(c)2170.2(a)1C; or
- c. Buildings that have no ducts in the attic in Climate Zones 2, 4, 9, 10, 12, and 14; or
- d. Buildings with R-2 or greater continuous insulation above or below the roof deck.

EXCEPTION 1 to Section 180.2(b)1Ai and ii: Roof area covered by building integrated photovoltaic panels and building integrated solar thermal panels are not required to meet the minimum requirements for solar reflectance, thermal emittance, or SR.

EXCEPTION 2 to Section 180.2(b)1Ai and ii: Roof constructions with a weight of at least 25 lb/ft² are not required to meet the minimum requirements for solar reflectance, thermal emittance, or SRI.

iii. For low-sloped roofs, the area of the roof recover or roof replacement shall be insulated to R-14 continuous insulation or a U-factor of .039 in Climate Zones 1, 2, 4, and 8 through 16.

EXCEPTION 1 to Section 180.2(b)1Aiii: Roof recovers with new R-10 insulation added above deck do not need to be insulated to meet R-14.

EXCEPTION 2 to Section 180.2(b)1Aiii: When existing mechanical equipment located on the roof will not be disconnected and lifted, insulation added may be limited to the greater of R-10 or the maximum installed thickness that will allow the distance between the height of the roof membrane surface to the top of the base flashing to remain in accordance with the manufacturer's instructions.

EXCEPTION 3 to Section 180.2(b)1Aiii: At the drains and other low points, tapered insulation with a thermal resistance less than R-14 may be used, provided that insulation thickness is increased at the high points of the roof so that the average thermal resistance equals or exceeds R-14

EXCEPTION 4 to Section 180.2(b)1Aiii: The area of the roof recoat is not required to be insulated.

B. Roof/Ceiling Insulation.

i. Attic Roof. Vented attics shall meet the following:

a. In Climate Zones 1 through 4 and 8 through 16, insulation shall be installed to achieve a weighted U-factor of 0.020 or insulation installed at the ceiling level shall result in an installed thermal resistance of R-49 or greater for the insulation alone; and

EXCEPTION 1 to Section 180.2(b)1Bia: In Climate Zones 1, 3, 4, and 9, Dwelling units with at least R-19 existing insulation installed at the ceiling level ~~with third party verification of existing conditions in Climate Zones 1, 3, 4, and 9.~~

b. In Climate Zones 2 and 11 through 16, air seal all accessible areas of the ceiling plane between the attic and the conditioned space in accordance with Section 110.7; and

EXCEPTION 1 to Section 180.2(b)1Bib: Dwelling units with at least R-19 existing insulation installed at the ceiling level ~~with third party verification of existing conditions.~~

EXCEPTION 2 to Section 180.2(b)1Bib: Dwelling units with atmospherically vented space heating or water heating combustion appliances located inside the pressure boundary of the dwelling unit.

c. In Climate Zones 1 through 4 and 8 through 16, recessed downlight luminaires in the ceiling shall be covered with insulation to the same depth as the rest of the ceiling. Luminaires not rated for insulation contact must be replaced or fitted with a fire-proof cover that allows for insulation to be installed directly over the cover; and

EXCEPTION 1 to Section 180.2(b)1Bic: In Climate Zones 1 through 4 and 8 through 10, Dwelling units with at least R-19 existing insulation installed at the ceiling level ~~with third party verification of existing conditions in Climate Zones 1 through 4 and 8 through 10.~~

d. Attic ventilation shall comply with ~~CBC~~ the California Building Code requirements.

EXCEPTION 1 to Section 180.2(b)1Bi: Dwelling units with at least R-38 existing insulation installed at the ceiling level ~~with third party verification of existing conditions.~~

EXCEPTION 2 to Section 180.2(b)1Bi: Dwelling units where the alteration would directly cause the disturbance of asbestos,

unless the alteration is made in conjunction with asbestos abatement.

EXCEPTION 3 to Section 180.2(b)1Bi: Dwelling units with knob and tube wiring located in the vented attic.

EXCEPTION 4 to Section 180.2(b)1Bi: Where the accessible space in the attic is not large enough to accommodate the required R-value, the entire accessible space shall be filled with insulation provided such installation does not violate Section 806.3 of Title 24, Part 2.5.

EXCEPTION 5 to Section 180.2(b)1Bi: Where the attic space above the altered dwelling unit is shared with other dwelling units and the requirements of Section 450.2(b)1A180.2(b)1Bi are not triggered for the other dwelling units.

Non Attic Roof. When low-sloped roofs are replaced and recovered, and meets Section 180.2(b)1A or B, the replaced area shall be insulated to R-14 continuous insulation or a U-factor of 0.055 in Climate Zones 1, 2, 4, and 8 through 16.-

EXCEPTION 1 to Section 180.2(b)1Bii: Roof recovers with new R-10 insulation added above deck do not need to be insulated to meet R-14.

EXCEPTION 2 to Section 180.2(b)1Bii: Roof replacements.

When existing mechanical equipment is located on the roof will not be disconnected and lifted, insulation added may be limited to the maximum insulation thickness that will allow a height in accordance with manufacturers' instructions from the roof membrane surface to the top of the base flashing or R-10, whichever is greater.

EXCEPTION 3 to Section 1180.2(b)1Bii: At the drains and other low points, tapered insulation with a thermal resistance less than R-14 may be used, provided that insulation thickness is increased at the high points of the roof so that the average thermal resistance equals or exceeds R-14-C.

Fenestration alterations other than repair shall meet the requirements below:

NOTE: Glass replaced in an existing sash and frame or sashes replaced in an existing frame are considered repairs. In these cases, Section 180.2(b) requires that the replacement be at least equivalent to the original in performance.

i. Fenestration products installed to replace existing fenestration products of the same total area shall meet either a or b:

- a. The maximum U-factor, RSHGC, and VT requirements of TABLE 180.2-B, or
- b. The area-weighted U-factor and RSHGC of TABLE 170.2-A.

EXCEPTION 1 to Section 180.2(b)1Ci: In an alteration, where'150 square feet or less of the entire building's vertical fenestration is replaced, RSHGC and VT requirements of TABLE 180.2-B shall not apply.

ii. Alterations that add fenestration and skylight area shall meet the total fenestration area requirements of Section 170.2(a) and the U-factor, RSHGC, and VT requirements of TABLE 180.2-B.

EXCEPTION 1 to Section 180.2(b)1Cii: Alterations that add fenestration area of up to 50 square feet shall not be required to meet the total fenestration area requirements of Sections 170.2(a), nor the U- factor, RSHGC, and VT requirements of TABLE 180.2-B.

EXCEPTION 2 to Section 180.2(b)1Cii: Alterations that add up to 16 square feet of new skylight area per dwelling unit with a maximum U-factor of 0.55 and a maximum RSHGC of 0.30 area shall not be required to meet the total fenestron area requirements of Section 170.2(a)3.

30. D. Exterior doors. Alterations that add exterior door area shall meet the U-factor requirement of Section 170.2(a)4.

Reference Appendices

Individual HPWH Ventilation

No changes to the Reference Appendices are required for this measure as currently written.

Master Mixing Valves

Changes to the Reference Appendices section is required for this measure.