

Proposal Summary



Return to Primary Configuration

Updated Friday, February 6, 2026

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Measure Description

This measure proposes to create a prescriptive pathway to require Return to Primary configuration for split Heat Pump Water Heater (HPWH) systems with recirculation in nonresidential buildings. This would include an alternative pathway for products on the Northwest Energy Efficiency Alliance (NEEA) Tier 3 qualified product list, including standardized configurations and manufacturer’s requirements. The proposed measure would update JA14 – Qualification Requirements for Hot Water Systems to include new requirements for the design, installation, equipment and control start up, and performance data reporting (Coefficient of Performance (COP), Defrost derate, Input power, Output Capacity, Refrigerant type, etc.).

This proposed measure would require additions to the compliance forms, changes to the compliance software, and new plan check and building inspector activities.

Table 1 summarizes the scope of the proposed code change. This requirement would apply to additions and alterations with a proposed water heater replacement with split HPWHs. The proposed measure does not require installation of HPWHs.

Table 1: Scope of Proposed Code Change

An “X” indicates the proposed code change is relevant.

Building Type(s)		single family	Construction Type(s)	X	new construction
		multifamily		X	additions
	X	nonresidential		X	alterations
Type of Change		mandatory	Updates to Compliance Software		no updates
	X	prescriptive		X	update existing feature
		performance		X	add new feature
Third Party Verification	X	no changes to third party verification			
		update existing verification requirements			

	add new verification requirements
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Justification for Proposed Change

The current nonresidential prescriptive requirements for water heating do not include requirements specific to HPWH performance despite the increasing use of HPWH in nonresidential applications. Pending air quality rules by the South Coast Air Quality Management District (SCAQMD) and the Bay Area Air Quality Management District (BAAQMD) will require HPWH installations for most buildings in California, since these two air quality districts cover roughly 49% of the sq ft. This measure, focused on nonresidential applications, draws on lessons learned from the development of multifamily requirements, including recent research (Brooks, Neal and Young 2024) (PG&E, SCE 2024) that indicates that Return to Primary is advantageous over swing tank configuration in many cases.

By eliminating the electric resistance (ER) swing tank, the proposed change would reduce electricity capacity requirements, peak demand, and grid impact, and improve grid reliability. The compact design of the Return to Primary configuration would reduce installation costs, space requirements, and the complexity of installation and start-up. Return to Primary configuration has a higher system (COP) than the temperature maintenance heater in series (TMHS) configuration, which would achieve operational savings. Proposed start-up requirements also ensure long-term savings for split HPWH systems with recirculation.

Data Needs / Information Requests

The Statewide CASE Team is seeking the following information to inform the code change proposal. Data may be provided anonymously. To participate or provide information, please email Yiyi Chu, YChu@trccompanies.com directly and copy info@title24stakeholders.com.

Data Needs include:

- Technical Feasibility
 - Current design, installation and start up practice for split HPWH with recirculation configurations and sizing in nonresidential buildings
- Market Readiness

- Sharing examples of installation of split HPWH in RtP configuration with recirculation outside research projects
- Current Practices/Naturally Occurring Market Adoption (NOMAD)
 - Market forces that drive the adoption of Return to Primary configurations in the coming years.

Draft Code Language

1.1 Guide to Marked Up Language

The proposed changes to the Standards and Reference Appendices are provided below. Changes to the 2025 documents are marked with blue underlining (new language) and ~~strikethroughs~~ (deletions).

1.2 Title 24, Part 1

There are not proposed changes to Title 24, Part 1.

1.3 Title 24, Part 6

SECTION 100.1 – Definitions and Rules of Construction

Temperature Maintenance Heater in Series (TMHS) Configuration is also known as swing tank configuration. This system configuration uses electric resistance storage water heater(s) in series with and downstream from the primary heat pump generation and storage system. The primary role of this heater is to maintain the temperature in the recirculation loop.

Primary Heat Pump Storage Tank is a tank that is heated by detached heat pump unit(s). The primary heat pump storage tank also maintains the temperature in the recirculation loop in Return to Primary configuration.

Return to Primary Configuration is a heat pump water heater configuration where the recirculation loop hot water return is piped to the cold-water supply pipe directly upstream of the primary heat pump storage tank(s) or directly to a dedicated recirculation return inlet of the primary heat pump storage tank(s).

Service Hot Water Systems heat, store, and distribute hot water to the point of use for sanitary purposes of human occupancy.

Heat Pump Water Heater System COP is calculated by using the heat Energy in the water (cold supply water + recirculated hot water) delivered to the distribution system divided by the total energy supplied to the heater for any selected period.

SECTION 140.5(a) Prescriptive Requirements for Service Water Heating Hot Water Systems

Nonresidential occupancies. Service water-heating hot water systems in nonresidential buildings shall meet the requirements of 1 or 2 and 3 below, or meet the performance compliance requirements of Section 140.1.

1. **School buildings less than 25,000 square feet and less than 4 stories in Climate Zones 2 through 15.** A heat pump water-heating system that meets the applicable requirements of Sections 110.1, 110.3 and 120.3.

Exception to Section 140.5(a)1 A water-heating system serving an individual bathroom space may be an instantaneous electric water heater.

2. **All other occupancies.** A service water-heating system that meets the applicable requirements of Sections 110.1, 110.3, 120.3 and 140.5(c).
3. Split heat pump water heating systems in all nonresidential occupancies shall meet the requirements of A or B below:

A. Installation shall follow the manufacturer's design and installation requirements. In addition:

- i. The primary heat pump water heater shall be a single-pass heat pump water heater.
- ii. The recirculation system hot water return shall directly connect to the primary heat pump storage tanks. For parallel storage tanks, the cold water inlet and recirculation system hot water return inlet shall be balanced.
- iii. In all heat pump operating modes, the maximum heat pump water heater compressor cut-off ambient air temperature shall be less than or equal to 23°F.
- iv. Manufacturer, design, installation and startup documentation shall be provided in accordance with JA14.3, 14.4, and 14.5.

B. Installation shall follow NEEA Advanced Water Heater Specification (AWHS) v8.1 for commercial heat pump water heater Tier 3 or higher. If installed in a TMHS configuration, the system shall satisfy the following additional requirements:

- i. The primary storage tank temperature setpoint shall be at least 135°F.
- ii. The temperature maintenance tank temperature setpoint shall be at least 10°F lower than the primary thermal storage tank temperature setpoint.
- iii. The fuel source for the temperature maintenance tank shall be electricity.

Section 141.0(a) Additions.

The code language for additions already references section 140.5 so the proposed changes to the new construction code language, which are a subsection of section 140.5, are already referenced. No change is necessary.

Section 141.0(b)2.N Alterations.

N. Service water-heating systems shall meet the requirements of Section 140.5(a)2 and (b), except for the solar water heating requirements. [Additionally, split heat pump water heaters with recirculation shall meet the requirements Section 140.5\(a\)3.](#)

1.4 Reference Appendices

JA14 – SECTION JA14.3.2 Performance Data Reporting

The following performance specifications shall be submitted to the Energy Commission, or refer to the [Product Assessment Datasheet \(PADS\) included in NEEA AWHS8.1](#):

- a) Water heater input power;
- b) Water heater output capacity; and
- c) [Water heater COHeat Pump Water Heater System COP referencing the equivalent or colder climate zone from the four IECC Climate Zones in NEEA Advanced Water Heater Specification, computed based on the approved method¹ of the Specification.](#)

The performance data shall be provided [in accordance with the Product Assessment Datasheet \(PADS\) included in NEEA AWHS8.1](#).

- ~~d) Inlet ambient air temperature: Maximum, minimum, and two midpoint temperatures of the manufacturer specified operating range.~~
- ~~e) Inlet water temperature: Maximum, minimum, and two midpoint temperatures of the manufacturer specified operating range.~~
- ~~f) Outlet water temperature: Maximum, midpoint, and minimum of outlet water (setpoint) temperatures of the manufacturer specified operating range.~~

For conditions where defrost strategies operate, reported data shall include at least one complete defrost cycle, or alternatively, for each model submitted for approval, provide a description of the defrost strategy, including method, cycle length, and process.

JA14 – SECTION JA14.4 Design Condition Documentation Requirements

The Central HPWH system shall be capable of supplying hot water at the design outlet water temperature under specified operating ranges for:

¹ See Section 3.4.1 and Appendix F of the [NEEA advanced Water Heating Specification](#).

- a. Minimum and maximum ambient air temperature;
- b. Minimum and maximum cold-water temperature;
- c. Minimum and maximum building demand at design draw and recovery conditions and duration; and
- d. Recirculation loop heat loss.

Design documentation shall specify the operating conditions at which the primary heat pump water heater can supply hot water at the design outlet water temperature without engaging the auxiliary heating mechanism.

[Design documentation shall document the defrost derate factors for calculating the output capacity on the design day.](#)

[JA 14 – SECTION JA14.5 Design, installation and start up documentation requirements](#)

The Statewide CASE Team is working through this subsection and will update this section.

Bibliography

- Brooks, Andrew, John Neal, and Nick Young. 2024. *Eliminating the Swing Tank and Other Design Considerations in Large-Capacity CO2 Heat Pump Water Heating*. 2024 ACEEE Summer Study on Energy Efficiency in Buildings. <https://www.aceee.org/sites/default/files/proceedings/ssb24/pdfs/Eliminating%20the%20Swing%20Tank%20and%20Other%20Design%20Considerations%20in%20Large-Capacity%20CO2%20Heat%20Pump%20Water%20Heating.pdf>.
- PG&E, SCE. 2024. "PG&E and SCE HPWH Laboratory Testing and Software Updates for Multifamily Applications." https://ecotope-publications-database.ecotope.com/2024_032_Final_Report_MF_HPWH_Lab_Testing_V2.pdf.