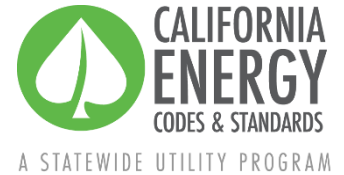


Proposal Summary



2022 California Energy Code (Title 24, Part 6)

Multifamily Domestic Hot Water – Hot Water Distribution

Updated: Monday, March 16, 2020

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Introduction

The document summarizes proposed revisions to the California Energy Code (Title 24, Part 6) that will be discussed during Round 2 of the utility-sponsored stakeholder meeting on March 17th, 2020. The Statewide Utility Codes and Standards Enhancement (CASE) Team is seeking input and feedback. To provide your comments, email info@title24stakeholders.com.

Measure Description

The 2013 Multifamily Central Domestic Hot Water (DHW) and Solar Water Heating CASE Reportⁱ estimated that 33 percent of hot water generated at the water heater is lost in the recirculation loop to ambient space. As a result of the 2013 CASE Report, currently Title 24 prescriptively requires demand control recirculation, as well as a minimum of two recirculation loops in multifamily buildings that have nine or more dwelling units.

The 2022 multifamily central domestic hot water distribution CASE measure will add a prescriptive requirement, change a mandatory requirement, and add a new compliance option. A summary of proposed changes includes:

- Submeasure A: Pipe Insulation Verification: Add a prescriptive requirement for field verification of pipe insulation quality
- Submeasure B: Increase stringency of existing mandatory pipe insulation thickness for pipes larger than two inches
- Submeasure C: Add a compliance option for pipe sizing according to California Plumbing Code (CPC) Appendix M.
- Change the existing prescriptive requirement for two recirculation loops in central DHW systems to a compliance option

The 2022 multifamily hot water distribution CASE measure will reduce the energy budget of multifamily DHW recirculation systems by adding a new prescriptive requirement, increasing the stringency of an existing mandatory requirement, while reducing compliance barriers by changing an existing prescriptive requirement to a compliance option, and adding a new compliance option.

All three proposed submeasures apply to new construction for all multifamily building types. None of the three proposed submeasures apply to additions or alterations.



1. **Submeasure A: Pipe Insulation Verification:** This submeasure involves adding a requirement for field verification of pipe insulation quality. Field verification would confirm installation of code minimum pipe insulation meeting California Plumbing Code (CPC) and Title 24, Part 6 including insulation on all fittings and valves, pumps, thermal isolation at pipe hangers, and overall insulation installation quality. This submeasure builds on the current low-rise residential pipe insulation inspection credit (PIC-H) and extends it to become a prescriptive baseline for all multifamily buildings with domestic hot water recirculation systems. This submeasure includes minor updates to default values for derating insulation quality in the compliance software.
2. **Submeasure B: Increased Insulation:** This submeasure increases mandatory pipe insulation requirements for multifamily domestic hot water (DHW) pipes two inches and larger. This submeasure also aligns pipe insulation requirements for all multifamily buildings. This submeasure includes minor updates to default insulation thickness values in the compliance software.
3. **Submeasure C: CPC Appendix M Pipe Sizing:** This submeasure adds a compliance option for pipe sizing based on CPC Appendix M (CPC 2019; UPC 2018). Appendix M is an optional appendix to CPC with an alternative pipe sizing procedure. Appendix M contains a performance-based pipe sizing calculation procedure that typically results in smaller pipe sizes than standard practice sizing, which results in lower first costs and distribution system heat loss. The current primary prescriptive baseline model assumes standard practice pipe sizing based on CPC Appendix A (fixture units, Hunter’s curve, etc.). This submeasure requires updates to the compliance software to include two pipe sizing approaches. The primary prescriptive baseline model assumes standard practice pipe sizing based on CPC (fixture units, Hunter’s curve, etc.).
3. **Change Existing Requirement for Two-Loop Recirculation Systems to a Compliance Option:** The 2022 multifamily DHW distribution CASE measure will change the existing requirement for two recirculation loops in central DHW systems to a compliance option, while reducing the performance budget for multifamily DHW recirculation systems with new requirements in Submeasure 1 and 2 described above. The current requirement for two loop recirculation systems has faced adoption challenges including inconsistent interpretations of meaning of the requirement and challenges establishing appropriate baseline and proposed systems in the California Compliance Simulation Engine (CSE). In addition, the two loop requirement was developed based on research on low-rise multifamily that is not directly applicable across all multifamily buildings types (low-rise, mid-rise, and high-rise). This measure requires minor updates to the compliance software.

Because there was limited data readily available on these submeasures, the Statewide CASE Team conducted primary data collection to determine existing insulation quality in coordination with subject matter experts. The Statewide CASE Team then analyzed energy savings with a spreadsheet calculator because compliance software cannot model these submeasures.

Draft Code Language



1.1 Submeasure A: Pipe Insulation Verification

Standards

SUBCHAPTER 8 LOW-RISE RESIDENTIAL BUILDINGS - PERFORMANCE AND PRESCRIPTIVE COMPLIANCE APPROACHES

SECTION 150.1 – PERFORMANCE AND PRESCRIPTIVE COMPLIANCE APPROACHES FOR LOW-RISE RESIDENTIAL BUILDINGS

[Item (c)8]

8. Domestic Water-Heating Systems. Water-heating systems shall meet the requirements of either A B or C. For recirculation distribution systems serving individual dwelling unit, only Demand Recirculation Systems with manual on/off control as specified in the Reference Appendix RA4.4.9 shall be used:

- A. For systems serving individual dwelling units, the water heating system shall meet the requirement of either i, ii, iii, iv, or v:
 - i. One or more gas or propane instantaneous water heater with an input of 200,000 Btu per hour or less and no storage tank.
 - ii. A single gas or propane storage type water heater with an input of 75,000 Btu per hour or less, rated volume less than or equal to 55 gallons and that meets the requirements of Sections 110.1 and 110.3. The dwelling unit shall have installed fenestration products with a weighted average U-factor no greater than 0.24, and in addition one of the following shall be installed:
 - a. A compact hot water distribution system that is field verified as specified in the Reference Appendix RA4.4.16; or
 - b. A drain water heat recovery system that is field verified as specified in the Reference Appendix RA3.6.9.
 - iii. A single gas or propane storage type water heater with an input of 75,000 Btu per hour or less, rated volume of more than 55 gallons.
 - iv. A single heat pump water heater. The storage tank shall be located in the garage or conditioned space. In addition, one of the following:
 - a. A compact hot water distribution system as specified in the Reference Appendix RA4.4.6 and a drain water heat recovery system that is field verified as specified in the Reference Appendix RA3.6.9; or
 - b. For Climate Zones 2 through 15, a photovoltaic system capacity of 0.3 kWdc larger than the requirement specified in Section 150.1(c)14; or
 - c. For Climate Zones 1 and 16, a photovoltaic system capacity of 1.1 kWdc larger than the requirement specified in Section 150.1(c)14.
 - v. A single heat pump water heater that meets the requirements of NEEA Advanced Water Heater Specification Tier 3 or higher. The storage tank shall be located in the garage or conditioned space. In addition, for Climate Zones 1 and 16, a photovoltaic system capacity of 0.3 kWdc larger than the requirement specified in Section 150.1(c)14 or a compact hot water distribution system as specified in the Reference Appendix RA4.4.6.

- B. For systems serving multiple dwelling units, a central water-heating system that includes the following components shall be installed:
- i. Gas or propane water heating system; and
 - ii. A recirculation system that meets the requirements of Sections 110.3(c)2 and 110.3(c)5, includes two or more separate recirculation loops serving separate dwelling units, and is capable of automatically controlling the recirculation pump operation based on measurement of hot water demand and hot water return temperature; and

EXCEPTION to Section 150.1(c)8Bii: Buildings with eight or fewer dwelling units may use a single recirculation loop.
 - iii. A solar water-heating system meeting the installation criteria specified in Reference Residential Appendix RA4 and with a minimum solar savings fraction of either a or b below:
 - a. 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
 - b. 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.
- iv. Recirculation system piping insulation quality shall be field verified and shall meet the criteria specified in Reference Appendix RA3.6.x.
- C. A water-heating system serving multiple dwelling units determined by the Executive Director to use no more energy than the one specified in subsection B above.

Reference Appendices

RA2.2 Measures that Require Field Verification and Diagnostic Testing

Table RA2-1 describes the measures that require installer certification and HERS Rater field verification and diagnostic testing, and identifies the protocol or test procedure in the Reference Residential Appendices that shall be used for completing installer and HERS Rater field verification and diagnostic testing.

Table RA2-1 – Summary of Measures Requiring Field Verification and Diagnostic Testing

Measure Title	Description	Procedure(s)
Duct Measures		
Duct Sealing	Component Packages require that space conditioning ducts be sealed. If sealed and tested ducts are claimed for compliance, field verification and diagnostic testing is required to verify that approved duct system materials are utilized, and that duct leakage meets the specified criteria.	RA3.1.4.3
Duct Location, Surface Area and R-value	Compliance credit can be taken for improved duct location, surface area and R-value. Field verification is required to verify that the duct system was installed according to the design, including location, size and length of ducts, duct insulation R-value and installation of buried ducts. ¹ For buried ducts measures, Duct Sealing and High Quality Insulation Installation (QII) is required.	RA3.1.4.1
Verification of low leakage ducts located entirely in conditioned space	Duct system location shall be verified by visual inspection and diagnostic testing. Compliance credit can be taken for verified duct systems with low air leakage to the outside when measured in accordance with Reference Residential Appendix Section RA3.1.4.3.8. Field Verification for ducts in conditioned space is required. Duct sealing is required.	RA3.1.4.3.8
Low Leakage Air-handling Units	Compliance credit can be taken for installation of a factory sealed air handling unit tested by the manufacturer and certified to the Commission to have met the requirements for a Low Leakage Air-Handling Unit. Field verification of the air handler’s model number is required. Duct Sealing is required.	RA3.1.4.3.9
Verification of Return Duct Design	Verification to confirm that the return duct design conform to the criteria given in TABLE 150.0-B or TABLE 150.0-C.	RA3.1.4.4
Verification of Air Filter Device Design	Verification to confirm that the air filter devices conform to the requirements given in Standards Section 150.0(m)12.	RA3.1.4.5
Verification of Prescriptive Bypass Duct Requirements	Verification to confirm zonally controlled systems comply with the bypass duct requirements in Section 150.1(c)13.	RA3.1.4.6
Air Conditioning Measures		
Improved Refrigerant Charge	Component Packages require in some climate zones that air-cooled air conditioners and air-source heat pumps be diagnostically tested in the field to verify that the system has the correct refrigerant charge. For the performance method, the Proposed Design is modeled with less efficiency if diagnostic testing and field verification is not performed. The system must also meet the prerequisite minimum System Airflow requirement.	RA3.3 RA3.2 RA1.2
Installation of Fault Indicator Display	Component Packages specify that a Fault Indicator Display can be installed as an alternative to refrigerant charge testing. The existence of a Fault Indicator Display has the same calculated benefit as refrigerant charge testing. Field verification is required.	RA3.4.2
Verified System Airflow	When compliance requires verified system airflow greater than or equal to a specified criterion, field verification and diagnostic testing is required.	RA3.3
Air-handling Unit Fan Efficacy	When compliance requires verified fan efficacy (Watt/cfm) less than or equal to a specified criterion, field verification and diagnostic testing is required.	RA3.3
Verified Energy Efficiency Ratio (EER)	Compliance credit can be taken for increased EER by installation of specific air conditioner or heat pump models. Field verification is required. ²	RA3.4.3 RA3.4.4.1

Measure Title	Description	Procedure(s)
Verified Seasonal Energy Efficiency Ratio (SEER)	HERS Rater field verification of the SEER rating is required for some systems.	RA3.4.3 RA3.4.4.1
Rated Heat Pump Capacity Verification	When performance compliance uses a heat pump, the rated capacity of the installed system shall be verified to be greater than or equal to the specified value.	RA3.4.4.2
Evaporatively Cooled Condensers	Compliance credit can be taken for installation of evaporatively cooled condensers. Field verification of duct leakage is required. Field verification of refrigerant charge is required. Field verification of EER is required.	RA3.1.4.3, RA3.2 RA3.4.3. RA3.4.4.1
Ventilation Cooling Measures		
Whole House Fan	When performance compliance uses a whole house fan, the installed whole house fan airflow rate (cfm) and fan efficacy (W/cfm) shall be verified to be equal to or better than the specified values.	RA3.9
Central Fan Ventilation Cooling System	When performance compliance uses a central fan ventilation cooling system (CFVCS), the installed CFVCS ventilation airflow rate (cfm) and fan efficacy (W/cfm) shall be verified to be equal to or better than the specified values.	RA3.3.4
Mechanical Ventilation Measures for Improved Indoor Air Quality		
Continuous Whole-Building Mechanical Ventilation Airflow	Measurement of whole-building mechanical ventilation is mandatory for newly constructed buildings.	RA3.7.4.1
Intermittent Whole-Building Mechanical Ventilation Airflow	Measurement of whole-building mechanical ventilation is mandatory for newly constructed buildings.	RA3.7.4.2
Building Envelope Measures		
Building Envelope Air Leakage	Compliance credit can be taken for reduced building envelope air leakage. Field verification and diagnostic testing is required.	RA3.8
Quality Insulation Installation (QII)	Compliance Software recognizes standard and improved envelope construction. Quality Insulation Installation is a prescriptive measure in all climate zones for newly constructed buildings and additions greater than 700 square feet, except low-rise multifamily buildings in Climate Zone 7. Field verification is required.	RA3.5
Quality Insulation Installation for Spray Polyurethane Foam (SPF) Insulation	A HERS Rater shall verify the installation of SPF insulation whenever R-values other than the default R-value per inch are used for compliance.	RA3.5.6

Measure Title	Description	Procedure(s)
Single Family Domestic Hot Water Measures		
Verified Pipe Insulation Credit (PIC-H)	Inspection to verify that all hot water piping in non-recirculating systems is insulated and that corners and tees are fully insulated. No piping should be visible due to insulation voids with the exception of the last segment of piping that penetrate walls and delivers hot water to the sink, appliance, etc.	RA3.6.3.
Verified Parallel Piping (PP-H)	Inspection that requires that the measured length of piping between the water heater and single central manifold does not exceed five feet	RA3.6.4
Verified Compact Hot Water Distribution System Expanded Credit (CHWDS-H-EX)	Field verification to insure that the eligibility criteria specified in RA 3.6.5 are met.	RA3.6.5
Demand Recirculation: Manual Control (RDRmc-H)	Inspection to verify that all recirculating hot water piping is insulated and that corners and tees are fully insulated. No piping should be visible due to insulation voids	RA3.6.6
Demand Recirculation: Sensor Control (RDRsc-H)	Inspection to verify that all recirculating hot water piping is insulated and that corners and tees are fully insulated. No piping should be visible due to insulation voids.	RA3.6.7
Verified Drain Water Heat Recovery System (DWHR-H)	Inspection to verify that the DWHR unit(s) and installation configuration match the compliance document and the DWHR(s) is certified to the Commission to have met the requirements.	RA3.6,9
Multi Family Domestic Hot Water Heating Measures		
Multiple Recirculation Loop Design for DHW Systems Serving Multiple Dwelling Units	Inspection that a central DHW system serving a building with more than eight dwelling units has at least two recirculation loops, each serving roughly the same number of dwelling units. These recirculation loops may the same water heating equipment or be connected to independent water heating equipment.	RA3.6.8
Verified Drain Water Heat Recovery System (DWHR-H)	Inspection to verify that the DWHR unit(s) and installation configuration match the compliance document and the DWHR(s) is certified to the Commission to have met the requirements.	RA3.6.9
<u>Domestic Hot Water Recirculation System Pipe Insulation Verification</u>	<u>Inspection to verify that domestic hot water recirculation systems are insulated including pipes, fittings, valves, pumps, and other piping devices. Metallic piping should be thermally isolated from pipe hangers. No piping should be visible due to insulation voids except piping specifically exempted in the California Plumbing Code or Title 24, Part 6.</u>	<u>RA3.6.x</u>
<p>1. Note: Compliance credit for increased duct insulation R-value (not buried ducts) may be taken without field verification if the R-value is the same throughout the building, and for ducts located in crawlspaces and garages where all registers are either in the floor or within 2 feet of the floor. These two credits may be taken subject only to enforcement agency inspection.</p> <p>2. Note: The requirement for verification of a high EER does not apply to equipment rated only with an EER.</p>		

RA3.6 Field Verification of Water Heating Systems

Section 3.6.x HERS – Verified Pipe Insulation Installation for Domestic Hot Water Recirculation Systems

Unless otherwise stated, insulation must meet the applicable requirements for coverage and thickness specified in Section 120.3. Pipe insulation shall fit tightly to the pipe, and all elbows, tees, valves, pumps, and other piping devices, shall be fully insulated. No piping shall be visible due to insulation voids. Metal pipe hangers supporting metal pipe shall have thermal isolation between the hanger and pipe.

Field verifications shall include visual inspection of the following portions of the recirculation system:

(a) All pipe insulation in the mechanical/boiler room where water heating equipment resides, or all outdoor pipes if water heater is outdoors.

(b) All pipe insulation on horizontal distribution pipes that function as a supply header, up the point of connection with riser pipes. Supply header is piping between the water heater and vertical risers that run up or down the building.

(c) A sample of pipe insulation on vertical pipe risers. The sample rate shall be one in seven risers. Riser inspection shall include the entire vertical length of DHW recirculation riser pipe, including offsets and horizontal portions of recirculation loop, up to the point of connection of the branch pipe (non-recirculating) to dwelling units.

1.2 Submeasure B: Increased Insulation

Standards

SUBCHAPTER 3 NONRESIDENTIAL, HIGH-RISE RESIDENTIAL, HOTEL/MOTEL OCCUPANCIES, AND COVERED PROCESSES—MANDATORY REQUIREMENTS

SECTION 120.3 – REQUIREMENTS FOR PIPE INSULATION

[Table 120.3-A]

TABLE 120.3-A PIPE INSULATION THICKNESS

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		
Space heating and Service Water Heating Systems (Steam, Steam Condensate, Refrigerant, Space Heating, Service Hot Water)				Minimum Pipe Insulation Required (Thickness in inches or R-value)						
Above 350	0.32-0.34	250	Inches	4.5	5.0	5.0	5.0	5.0		
			R-value	R 37	R 41	R 37	R 27	R 23		
251-350	0.29-0.32	200	Inches	3.0	4.0	4.5	4.5	4.5		
			R-value	R 24	R 34	R 35	R 26	R 22		
201-250	0.27-0.30	150	Inches	2.5	2.5	2.5	3.0	3.0		
			R-value	R 21	R 20	R 17.5	R 17	R 14.5		
141-200	0.25-0.29	125	Inches	1.5	1.5	2.0	2.0	2.0		
			R-value	R 11.5	R 11	R 14	R 11	R 10		
105-140	0.22-0.28	100	Inches	1.0	1.5	1.5	1.5	1.5		
			R-value	R 7.7	R 12.5	R 11	R 9	R 8		
				Nominal Pipe Diameter (in inches)						
				< 1	1 to <1.5	1.5 to < 4	4 to < 8	8 and larger		
Space cooling systems (chilled water, refrigerant and brine)				Minimum Pipe Insulation Required (Thickness in inches or R-value)¹						
40-60	0.21-0.27	75	Inches	Nonres 0.5	Res 0.75	Nonres 0.5	Res 0.75	1.0	1.0	1.0
			R-value	Nonres R 3	Res R 6	Nonres R 3	Res R 5	R 7	R 6	R 5
Below 40	0.20-0.26	50	Inches	1.0	1.5	1.5	1.5	1.5		
			R-value	R 8.5	R 14	R 12	R 10	R 9		
				Minimum Pipe Insulation Required (Thickness in inches or R-value)						
				< 1	1 to <1.5	1.5 to < 4	4 to < 8	8 and larger		
Multifamily Domestic Hot Water Systems										
105-140	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 120.3-A:										
1. These thickness are based on energy efficiency considerations only. Issues such as water vapor permeability or surface condensation sometimes require vapor retarders or additional insulation.										

EXCEPTION 1 to Section 120.3: Factory-installed piping within space-conditioning equipment certified under Section 110.1 or 110.2.

EXCEPTION 2 to Section 120.3: Piping that conveys fluids with a design operating temperature range between 60°F and 105°F.

EXCEPTION 3 to Section 120.3: Where the heat gain or heat loss to or from piping without insulation will not increase building source energy use.

EXCEPTION 4 to Section 120.3: Piping that penetrates framing members shall not be required to have pipe insulation for the distance of the framing penetration. Metal piping that penetrates metal framing shall use grommets, plugs, wrapping or other insulating material to assure that no contact is made with the metal framing.

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.

SUBCHAPTER 7 LOW-RISE RESIDENTIAL BUILDINGS – MANDATORY FEATURES AND DEVICES

SECTION 150.0 – MANDATORY FEATURES AND DEVICES

[Item (j)]

(j) Insulation for Piping and Tanks

1. **Storage tank insulation.** Unfired hot water tanks, such as storage tanks and backup storage tanks for solar water-heating systems, shall be externally wrapped with insulation having an installed thermal resistance of R-12 or greater or have internal insulation of at least R-16 and a label on the exterior of the tank showing the insulation R-value.
2. **Water piping, solar water-heating system piping, and space conditioning system line insulation thickness and conductivity.** Piping shall be insulated as follows:
 - A. All **single family** domestic hot water piping shall be insulated as specified in Section 609.11 of the California Plumbing Code. In addition, the following piping conditions shall have a minimum insulation wall thickness of 1 inch or a minimum insulation R-value of 7.7:
 - i. The first 5 feet (1.5 meters) of cold water pipes from the storage tank.
 - ii. All hot water piping with a nominal diameter equal to or greater than 3/4 inch (19 millimeter) and less than 1 inch.
 - iii. All hot water piping with a nominal diameter less than 3/4 inch that is:
 - a. Associated with a domestic hot water recirculation system;
 - b. From the heating source to the kitchen fixtures;
 - c. From the heating source to a storage tank or between storage tanks; or
 - d. Buried below grade.
 - B. Piping for **multifamily domestic hot water systems**, space conditioning systems, solar water-heating system collector loop, and distribution piping for steam and hydronic heating system, shall meet the requirements of Section 120.3(c).

EXCEPTION 1 to Section 150.0(j)2: Factory-installed piping within space-conditioning equipment certified under Section 110.1 or 110.2.

EXCEPTION 2 to Section 150.0(j)2: 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 assure that no contact is made with the metal framing. Insulation shall abut securely against all framing members.

EXCEPTION 3 to Section 150.0(j)2: 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 the Reference Residential Appendix RA3.5.

EXCEPTION 4 to Section 150.0(j)2: Piping surrounded with a minimum of 1 inch of wall insulation, 2 inches of crawlspace insulation, or 4 inches of attic insulation, shall not be required to have pipe insulation.

3. **Insulation Protection.** Pipe insulation shall meet the insulation protection requirements of Section 120.3(b).

Reference Appendices

The proposed code change will not modify the Reference Appendices documents.

1.3 Submeasure C: CPC Appendix M Pipe Sizing

Standards

There are no proposed changes to the standards

Reference Appendices

The proposed code change will not modify the Reference Appendices documents.

1.4 Change Existing Requirement for Two-Loop Recirculation Systems to a Compliance Option

Standards

SUBCHAPTER 8 LOW-RISE RESIDENTIAL BUILDINGS - PERFORMANCE AND PRESCRIPTIVE COMPLIANCE APPROACHES

SECTION 150.1 - PERFORMANCE AND PRESCRIPTIVE COMPLIANCE APPROACHES FOR LOW-RISE RESIDENTIAL BUILDINGS

[Item (c)8B ii]

8. **Domestic Water-Heating Systems.** Water-heating systems shall meet the requirements of either A B or C. For recirculation distribution systems serving individual dwelling unit, only Demand Recirculation Systems with manual on/off control as specified in the Reference Appendix RA4.4.9 shall be used:
 - A. For systems serving individual dwelling units, the water heating system shall meet the requirement of either i, ii, iii, iv, or v:

- i. One or more gas or propane instantaneous water heater with an input of 200,000 Btu per hour or less and no storage tank.
 - ii. A single gas or propane storage type water heater with an input of 75,000 Btu per hour or less, rated volume less than or equal to 55 gallons and that meets the requirements of Sections 110.1 and 110.3. The dwelling unit shall have installed fenestration products with a weighted average U-factor no greater than 0.24, and in addition one of the following shall be installed:
 - a. A compact hot water distribution system that is field verified as specified in the Reference Appendix RA4.4.16; or
 - b. A drain water heat recovery system that is field verified as specified in the Reference Appendix RA3.6.9.
 - iii. A single gas or propane storage type water heater with an input of 75,000 Btu per hour or less, rated volume of more than 55 gallons.
 - iv. A single heat pump water heater. The storage tank shall be located in the garage or conditioned space. In addition, one of the following:
 - a. A compact hot water distribution system as specified in the Reference Appendix RA4.4.6 and a drain water heat recovery system that is field verified as specified in the Reference Appendix RA3.6.9; or
 - b. For Climate Zones 2 through 15, a photovoltaic system capacity of 0.3 kWdc larger than the requirement specified in Section 150.1(c)14; or
 - c. For Climate Zones 1 and 16, a photovoltaic system capacity of 1.1 kWdc larger than the requirement specified in Section 150.1(c)14.
 - v. A single heat pump water heater that meets the requirements of NEEA Advanced Water Heater Specification Tier 3 or higher. The storage tank shall be located in the garage or conditioned space. In addition, for Climate Zones 1 and 16, a photovoltaic system capacity of 0.3 kWdc larger than the requirement specified in Section 150.1(c)14 or a compact hot water distribution system as specified in the Reference Appendix RA4.4.6.
- B. For systems serving multiple dwelling units, a central water-heating system that includes the following components shall be installed:
- i. Gas or propane water heating system; and
 - ii. A recirculation system that meets the requirements of Sections 110.3(c)2 and 110.3(c)5; ~~includes two or more separate recirculation loops serving separate dwelling units;~~ and is capable of automatically controlling the recirculation pump operation based on measurement of hot water demand and hot water return pump temperature; ~~and~~
~~EXCEPTION to Section 150.1(c)8Bii: Buildings with eight or fewer dwelling units may use a single recirculation loop.~~
 - iii. A solar water-heating system meeting the installation criteria specified in Reference Residential Appendix RA4 and with a minimum solar savings fraction of either a or b below:
 - a. 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

- b. 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.
- C. A water-heating system serving multiple dwelling units determined by the Executive Director to use no more energy than the one specified in subsection B above.

Reference Appendices

RA3.6.8 HERS-Multiple Recirculation Loop Design for DHW Systems Serving Multiple Dwelling Units

The visual inspection shall verify that a central DHW system ~~serving a building with more than eight dwelling units~~ has at least two recirculation loops, ~~each serving roughly the same number of dwelling. Unique building sections may have additional recirculation loops.~~ These recirculation loops may be connected to the same water heating equipment or be connected to independent water heating equipment. The HERS inspector shall verify that there are at least two recirculation loops each serving roughly the same number of dwelling units. Unique sections of the building may have separate loops. ~~Ideally each loop will have its own pump and controls.~~

ⁱ https://title24stakeholders.com/wp-content/uploads/2017/10/2013_CASE-Report_Multifamily-Central-DHW-and-Solar-Water-Heating.pdf