Hot Water Recirculation Loop
Field Verification Requirements

Multiple Recirculation Loop Credit, Multifamily

The HERS Rater is required to verify the following items including the installation criteria below according to forms CF-3R-PLB-21-H or for non-residential projects the NRCV-PLB-21-H as applicable.

1. All buildings with 8 or more dwelling units have a minimum of 2 recirculation loops.
2. Each loop roughly serves the same number of dwellings.
3. Each loop will have its own pump and controls.

RA3.6.9 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 units. 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:

(a) 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.

1. Installation Criteria

Recirculation Systems Serving Multiple Dwelling Units

Multifamily buildings may have individual water heaters for each unit, but they are more likely to have a central water heating system with a recirculation loop that supplies each of the units. This recirculation loop is comprised of a supply portion, of larger diameter pipe connected to smaller diameter branches that serve multiple dwelling units, guest rooms, or fixtures and a return portion that completes the loop back to the water heating equipment. The large volume of water which is recirculated during periods of high use creates situations that require the installation of certain controls and servicing mechanisms to optimize performance and allow for lower cost of maintenance. The following paragraphs cover the requirements for systems serving multiple dwelling units and with recirculation loops and may also apply to individual dwelling units with recirculation systems.

Outlet Temperature controls

§110.3(c)1 On systems that have a total capacity greater than 167,000 Btu/hr., outlets that require higher than service water temperatures as listed in the ASHRAE Handbook, Applications Volume, shall have separate remote heaters, heat exchangers, or boosters to supply the outlet with the higher temperature.

Controls for Hot Water Distribution Systems

§110.3(c)2

Service hot water systems with circulating pumps or with electrical heat trace systems shall be capable of automatically turning off the system.

Insulation, Storage Tanks

§110.3(c)4

Insulation. Unfired service water heater storage tanks and backup tanks for solar water-heating systems shall have:

i. External insulation with an installed R-value of at least R-12; or

ii. Internal and external insulation with a combined R-value of at least R-16; or

iii. The heat loss of the tank surface based on an 80°F water-air temperature difference shall be less than 6.5 Btu per hour per square foot.

Any unfired tanks (used as a back-up for solar water heating or as storage for a boiler) must either be insulated externally with R-12 or have a label indicating the tank is internally insulated with R-16.

Air Release Valves

§110.3(c)5A

Air release valve or vertical pump installation. An automatic air release valve shall be installed on the recirculation loop piping on the inlet side of the recirculation pump and no more than 4 feet from the pump. This valve shall be mounted on top of a vertical riser at least 12" in length and shall be accessible for replacement and repair. Alternatively, the pump shall be installed on a vertical section of the return line.

The constant supply of new water in combination with the continuous operation of the pump creates the possibility of the pumps cavitation due to air in the water. Cavitation is the formation of bubbles in the low pressure liquid on the suction side of the pump. The cavities or bubbles will collapse when they pass into the higher regions of pressure, causing noise, and vibration, which may lead to damage to many of the components. In addition there is a loss in capacity and the pump can no longer build the same head (pressure). Ultimately this impacts the pump's efficiency and life expectancy.

Cavitation shall be minimized by either the installation of an air release valve or mounting the pump vertically. The air release valve must be located no more than 4 feet from the inlet of the pump. The air release valve must be mounted on a vertical riser with a length of at least 12 inches.

Backflow Prevention

§110.3(c)5B

Recirculation loop backflow prevention. A check valve or similar device shall be located between the recirculation pump and the water heating equipment to prevent water from flowing backwards though the recirculation loop.

Temperature and pressure differences in the water throughout a recirculation system can create potentials for backflows. This can result in cooler water from the bottom of the water heater tank and water near the end of the recirculation loop flowing backwards towards the hot water load and reducing the delivered water temperature. To prevent this from occurring, the Standards require that a check valve or similar device be located between the recirculation pump and the water heating equipment.

Equipment for Pump Priming/Pump Isolation Valves

§110.3(c)5C

Equipment for pump priming. A hose bibb shall be installed between the pump and the water heating equipment. An isolation valve shall be installed between the hose bibb and the water heating equipment. This hose bibb is used for bleeding air out of the pump after pump replacement.

§110.3(c)5D

Pump isolation valves. Isolation valves shall be installed on both sides of the pump. These valves may be part of the flange that attaches the pump to the pipe. One of the isolation valves may be the same isolation valve as in Item C.

A large number of systems are allowed to operate until complete failure simply because of the difficulty of repair or servicing. Repair labor costs can be reduced significantly by planning ahead and designing for easy pump replacement when the pump fails. Provision for pump priming and pump isolation valves help reduces maintenance costs.

To meet the pump priming equipment requirement, a hose bibb must be installed between the pump and the water heater. In addition, an isolation valve shall be installed between the hose bibb and the water heating equipment. This configuration will allow the flow from the water heater to be shut off, allowing the hose bibb to be used for bleeding air out of the pump after pump replacement.

The requirement for the pump isolation valves will allow replacement of the pump without draining a large portion of the system. The isolation valves shall be installed on both sides of the pump. These valves may be part of the flange that attaches the pump to the pipe. One of the isolation valves may be the same isolation valve as in paragraph C.

Connection of Recirculation Lines

§110.3(c)5E

Cold water supply and recirculation loop connection to hot water storage tank. Storage water heaters and boilers shall be plumbed in accordance with the manufacturer's specifications. The cold water piping and the recirculation loop piping shall not be connected to the hot water storage tank drain port.

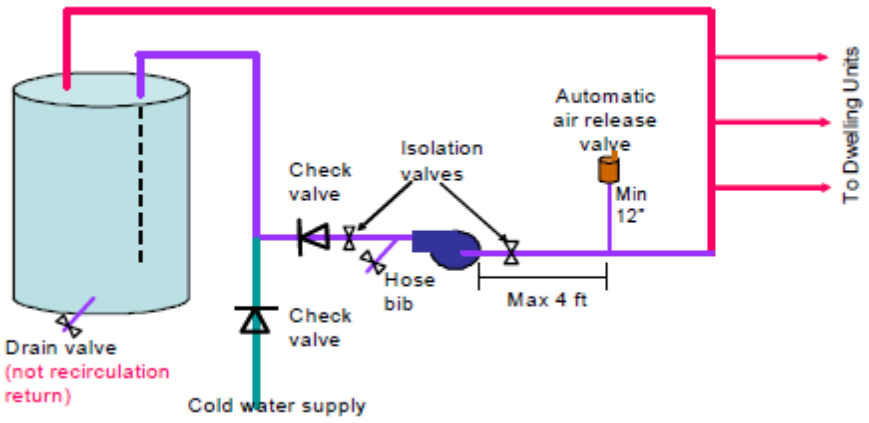
Manufacturer's specifications should always be followed to assure optimal performance of the system. The cold water piping and the recirculation loop piping should never be connected to the hot water storage tank drain port.

Backflow Prevention in Cold Water Supply

§110.3(c)5F

Cold water supply backflow prevention. A check valve shall be installed on the cold water supply line between the hot water system and the next closest tee on the cold water supply line. The system shall comply with the expansion tank requirements as described in the California Plumbing Code Section 608.3.

The dynamic between the water in the heater and the cold water supply are similar to those in the recirculation loop. Thermo-syphoning can occur on this side of this loop just as it does on the recirculation side of the system. To prevent this, the Standards require a check valve to be installed on the cold water supply line. The valve should be located between the hot water system and the next closest tee on the cold water supply line. Note that the system shall comply with the expansion tank requirements as described in the *California Plumbing Code Section 608.3.*



Dedicated Return Line

§120.3

Distribution systems must have a dedicated return line which is fully insulated. Requirements for Pipe Insulation

HERS verification of Pipe Insulation requirements follows RA3.6.2 and the associated installation criteria discussed previously.

All hot water pipes are insulated per the insulation requirements of Table 120.3A (1" insulation for 1" and smaller pipes. 1.5" insulation for 1 to 1.5 inch pipes).

§150.0(j)2

All domestic hot water system piping conditions listed below, whether buried or unburied, must be insulated and the insulation thickness shall be selected based on the conductivity range in TABLE 120.3-A and the insulation level shall be selected from the fluid temperature range based on the thickness requirements in TABLE 120.3-A:

i. *The first 5 feet (1.5 meters) of hot and cold water pipes from the storage tank.*

ii. *All piping with a nominal diameter of 3/4 inch (19 millimeter) or larger.*

iii. *All piping associated with a domestic hot water recirculation system.*

iv. *Piping from the heating source to storage tank or between tanks.*

v. *Piping buried below grade.*

vi. *All hot water pipes from the heating source to the kitchen fixtures.*

TABLE 120.3-A PIPE INSULATION THICKNESS

FLUID TEMPERATURE RANGE (°F)	CONDUCTIVITY RANGE (in Btu-inch per hour per square foot per °F)	INSULATION MEAN RATING TEMPERATURE (°F)	NOMINAL PIPE DIAMETER (in inches)				
			1 and less	1 to <1.5	1.5 to < 4	4 to < 8	8 and larger
			INSULATION THICKNESS REQUIRED (in inches)				
Space heating, Hot Water systems (steam, steam condensate and hot water) and Service Water Heating Systems							
Above 350	0.32-0.34	250	4.5	5.0	5.0	5.0	5.0
251-350	0.29-0.31	200	3.0	4.0	4.5	4.5	4.5
201-250	0.27-0.30	150	2.5	2.5	2.5	3.0	3.0
141-200	0.25-0.29	125	1.5	1.5	2.0	2.0	2.0
105-140	0.22-0.28	100	1.0	1.5	1.5	1.5	1.5
Space cooling systems (chilled water, refrigerant and brine)							
40-60	0.21-0.27	75	0.5	0.5	1.0	1.0	1.0
Below 40	0.20-0.26	50	1.0	1.5	1.5	1.5	1.5