VERIFIED MULTIFAMILY CENTRAL HOT WATER SYSTEM DISTRIBUTION

SAMPLE FORM – NOT VALID FOR SUBMISSION TO BUILDING DEPARTMENTS

CERTIFICATE OF VERIFICATION

Note: This table completed by ECC Registry.

Project Name:	Enforcement Agency:
Dwelling Address:	Permit Number:
City and Zip Code:	Permit Application Date:

A. General Information

01	Building Name	

B. Design Verified Central Water Heating Systems Information (other than CHPWH)

This table reports features of the water heating system other than **CHPWH** system that were specified on the registered LMCC compliance document for this project.

01	02	03	04	05	06	07	08	09	10	11	12
Water Heating System ID or Name	Water Heating System Type	Water Heater Type	# of Water Heaters in System	Water Heater Storage Volume (gal)	Fuel Type	Rated Input Type	Rated Input Value	Heating Efficiency Type	Heating Efficiency Value	Standby Loss (%)	Exterior Insul. R-Value

B2. Design Verified CHPWH System Information

This table reports the water heating systems specified on the registered LMCC compliance document for this project.

01	02	03	04	05	06	07	08	09	10	11	12
Water Heating System ID or Name	Modeled Equipment Make and Model	# of Water Heaters/ Compressors	Primary Tank Location	Primary Tank Volume	Primary Tank Total Insulation	Loop Tank Location	Loop Tank Volume	Loop Tank Total Insulation	Loop Pipe Insulation Thickness	Loop Tank Type	Simulated Equipment Make and Model

C. Installed Verified Central Water Heating Systems Information

This table reports the water heating system features other than **CHPWH** systems that were specified on the registered LMCC compliance document for this project.

01	02	03	04	05	06	07	08	09	10	11	12
Water Heating System ID or Name	Water Heating System Type	Water Heater Type	# of Water Heaters in System	Water Heater Storage Volume (gal)	Fuel Type	Rated Input Type	Rated Input Value	Heating Efficiency Type	Heating Efficiency Value	Standby Loss (%)	Exterior Insul. R-Value
13	Compliance Statement										

C2. Installed Verified CHPWH System Information

This table reports the water heating systems specified on the registered LMCC compliance document for this project.

01	02	03	04	05	06	07	08	09	10	11
Water Heating System ID or Name	Modeled Equipment Make and Model	# of Water Heaters/ Compressors	Primary Tank Location	Primary Tank Volume	Primary Tank Insulation	Loop Tank Location	Loop Tank Volume	Loop Tank Insulation	Loop Pipe Insulation Thickness	Loop Tank Type

D. Design Verified Central Water Heating Distribution Systems Information

This table reports the water heating distribution types specified on the registered LMCC compliance document for this project.

01	02	03	04	05	06
Water Heating System ID or Name	Central DHW System Distribution Type	Dwelling Unit DHW System Distribution Type	California Plumbing Code Appendix M	Master Mixing Valve	Insulation Verification

E. Installed Verified Central Water Heating Distribution Systems Information

This table reports the water heating distribution types specified on the registered LMCC compliance document for this project.

01	02	03	04	05	06
Water Heating System ID or Name	Central DHW System Distribution Type	Dwelling Unit DHW System Distribution Type	California Plumbing Code Appendix M	Master Mixing Valve	Insulation Verification

F. Installed Verified Water Heater Manufacturer Information

01	02	03
Water Heating System ID or Name	Manufacturer	Model Number

G. Mandatory Requirements for All Central Domestic Hot Water Systems

The responsible person's signature on this compliance document affirms that all applicable requirements in this table have been met unless otherwise noted in the Verification Status and the Corrections Notes in this table.

01	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 have separate remote heaters, heat exchangers, or boosters to supply the outlet with the higher temperature. (Section 110.3 (c)1)
02	Systems with circulating pumps or with electrical heat trace systems shall be capable of automatically turning off the system. (Section 110.3(c)2).
03	Unfired storage tanks are insulated with: • External insulation of R-3.5, or • Internal insulation of R-16, or • The heat loss of the tank surface based on an 80°F water-air temperature difference shall be less than 6.5 Btuh/ft^2. (Section 110.3(c)4).
04	Recirculation loops shall meet the following requirements: • The recirculation pump is mounted on a vertical section of the return line, OR an automatic air release valve is installed on a riser at least 12 inches in length, on the inlet side of the recirculation pump, no more than 4 feet from the pump. (Section 110.3(c) 4A). • 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. (Section 110.3(c) 4B). • A hose bib is installed between the pump and the water heating equipment with an isolation valve between the hose bib and the water heating equipment. (Section 110.3(c) 4C). • Isolation valves shall be installed on both sides of the pump, of which the valve required in 110.3(c)4C can be one. (Section 110.3(c)4D). • The cold water piping and the recirculation loop piping shall not be connected to the hot water storage tank drain port. (Section 110.3(c)4E). • 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. (Section 110.3(c) 4F).
05	Instantaneous water heaters with an input greater than 6.8 kBTU/hr. (2kW) shall have isolation valves on both the cold water supply and the hot water line. (110.3 (c) 6).
06	Domestic hot water piping insulation requirements (Section 150(J)): • All domestic hot water piping shall be insulated as specified in Section 609.12 of the California Plumbing Code. Insulation buried below grade must be installed in a waterproof and non-crushable casing or sleeve. • Pipe insulation shall fit tightly and all elbows and tees shall be fully insulated. • 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 butt securely against all framing members. • 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. • Insulation is not required on the cold water line when it is used as the return.
07	**Domestic hot water piping insulation requirements**: See the exceptions to Section 160.4(e) All piping for multifamily domestic hot water systems shall be insulated and meet the applicable requirements below: **1. General Requirements:** 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 domestic hot water system appurtenances shall be continuous. c. Pipe supports, hangers, and pipe clamps shall be attached on the outside of rigid pipe insulation to prevent thermal bridges. 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: i. 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. ii. Where the outer diameter of the appurtenance is greater than the outer diameter of the insulated pipe that it is attached to, the appurtenance shall be insulated with a minimum thickness of 1 inch. iii. The insulation shall be removable and re-installable to ensure maintenance or replacement services can be completed. iv. Valves shall be fully functional without impediment from the insulation.

07	**2. Insulation Thickness:** All piping for multifamily domestic hot water systems shall meet the insulation thickness requirements specified in of Table 160.4-A. a. For insulation conductivity in the range shown in Table 160.4-A for the applicable fluid temperature range, the insulation shall have the applicable minimum thickness or R-value shown in Table 160.4-A. b. if the insulation conductivity falls outside the range provided in Table 160.4-A applicable fluid temperature range, the insulation shall meet a minimum R-value as indicated in Table 160.4-A. Or, it can have a thickness determined using Equation 160.4-A. c. Insulation conductivity shall be determined in accordance with ASTM C335 at the mean temperature listed in Table 160.4-A, and shall be rounded to the nearest 1/100 Btu-inch per hour per square foot per °F. **3. Insulation Protection:** Pipe Insulation shall be protected from damage due to sunlight, moisture, equipment maintenance and wind. Protection shall, at minimum, include the following: a. Pipe and appurtenance insulation exposed to weather shall be protected by a cover suitable for outdoor service. The cover shall be water retardant and provide shielding from solar radiation that can cause degradation of the material. Appurtenance insulation covers shall be removable and able to be reinstalled. Adhesive tape shall not be used to provide this protection. b. 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. **c.** Pipe insulation buried below grade must be installed in a waterproof and noncrushable casing or sleeve.	
08	Verification Status:	☐ Pass - all applicable requirements are met; or ☐ Fail - one or more applicable requirements are not met. Enter reason for failure in corrections notes field below; or ☐ All N/A - This entire table is not applicable
09	Correction Notes:	

H. California Plumbing Code Appendix M

The responsible person's signature on this compliance document affirms that all applicable requirements in this table have been met.

01	All distribution piping shall be sized according to the methodology specified in the California Plumbing Code Appendix M.

I. Verified Multiple Dwelling Units Master Mixing Valves Installation Requirements

For central systems with hot water piping serving multiple dwelling units master mixing valves (MMV) shall meet the following minimum specification, installation, and startup requirements specified in RA4.4.19.

The responsible person's signature on this compliance document affirms that all applicable requirements in this table have been met unless otherwise noted in the Verification Status and the Corrections Notes in this table.

01	***Plumbing Plans:*** The plumbing plans shall include the following MMV specification at a minimum: a. Manufacturer's installation and commissioning instructions and plumbing drawings. b. MMV conforms to the American Society of Sanitation Engineers (ASSE) 1017-2009 standard, Performance Requirements for Temperature Actuated Mixing Valves for Hot Water Distribution Systems. c. Water mixing parameters and associated values: 1. Input parameters A. Recirculation pump flow rate A. Recirculation pump flow rate B. Mixing valve outlet water temperature C. Recirculation return water temperature D. Mixing valve hot inlet water temperature 2. Calculated parameters A. Percentage of water flow returning to cold side of MMV A. Percentage of water flow returning to hot side of MMV B. Percentage of water flow returning to hot side of MMV 3. Manufacturer's operating parameter A. Maximum water mixing ratio

02	***Installation:*** Installation of MMV shall meet manufacturer's instruction and the following requirements at a minimum: a. The MMV shall be installed on the central heating plant hot water supply outlet header leading to the recirculation loop. b. Check valves installed on the recirculation return line and cold-water line to inlet cold connection of MMV and on recirculation return piping leading back to storage tank or water heater. c. Isolation valves installed on the inlet cold water, inlet recirculation return, inlet hot and outlet connections to MMV and on recirculation return piping connection to storage tank or water heater. d. Balancing valve installed on the recirculation return piping to the water heater for MMVs that cannot 100% close the hot inlet port during operation. e. Thermometers installed on the outlet of the MMV and on the recirculation return line next the water pump.	
03	***Startup:*** a. Startup testing of MMV during recirculation only operation. 1. Close all hot fixtures in the domestic water system. 2. Ensure that the water heater is operational and idling with storage tank plumbed to the mixing valve and meeting the hot inlet temperature specified in the plumbing plans. 3. Start the recirculation pump and set mixed outlet temperature or setpoint temperature on the MMV. Start the circulation pump at the specified water flow rate and adjust as needed to meet recirculation return temperature specified in the plumbing plans. 4. Let distribution system warm up and stabilize for 30 minutes and adjust mixing parameters as needed to realign with values in plumbing plans. 5. Let the recirculation pump operate for three hours without any water draws to ensure there is no temperature creep. 6. If during or after the three-hour period the MMV outlet and return temperature stays elevated by greater than 2°F and doesn't return back to the specified temperature, then make necessary adjustments to the MMV. If temperature creep persists with mechanical MMV, adjust the balancing valve as necessary on the recirculation return line leading back to the water heater to ensure average MMV outlet temperature meets the specified temperature. 7. If adjustments are made to MMV or balancing valve in Step 6, then repeat Step 5. b. Startup testing of MMV for a combination of recirculation and hot water draws. 1. Once the MMV is operational in a closed loop, make a water draw for 10 minutes using one of the following options: A. With a shower operating at full flow at every: three dwelling units in a building with 15 or fewer dwelling units, five dwelling units in a building with 16 to 30 dwelling units, eight dwelling units in a building with 31 to 60 dwelling units, ten dwelling. B. The hot water valve on a hose bib, mop sink, or other fixture on the branch line or location on the hot water distribution line is opened to a draw volume of 1 gpm for every: three dwelling units in a building with 15 or fewer dwelling units, five dwelling units in a building with 16 to 30 dwelling units, eight dwelling units in a building with 31 to 60 dwelling units, ten dwelling units in a building than 60 to 200 dwelling units, twenty dwelling units in a building with more than 200 dwelling units. 2. Monitor recirculation return temperature on the thermometer during the 10-minute draw period and ensure design return water temperature is maintained at the specified temperature documented in the plumbing plans. 3. If the recirculation return temperature falls more than 5°F below the specified temperature during the draw period, then adjust MMV setup to ensure compliance.	
04	Verification Status:	☐ Pass - all applicable requirements are met; or ☐ Fail - one or more applicable requirements are not met. Enter reason for failure in corrections notes field below; or ☐ All N/A - This entire table is not applicable
05	Correction Notes:	

J. Verified Pipe Insulation for Central System

The responsible person's signature on this compliance document affirms that all applicable requirements in this table have been met.

01	The heating plant and recirculation system piping insulation installation quality shall be field verified by a ECC-rater. The ECC-rater shall inspect the heating plant and horizontal supply header and return piping in accordance with mandatory requirements in Title 24 Part 6 section 160.4. The rater shall use a sampling approach that one in seven DHW recirculation pipe risers and associated branches be inspected to verify the pipe insulation meet with the following requirements: a. All piping for multifamily domestic hot water systems shall be insulated to the thickness specified in Table 160.4-A, including the first 8 feet of inlet cold water piping to the heating plant. Insulation on the piping and appurtenances shall be continuous. b. All appurtenances at the heating plant, from a heating source to storage tank(s), or in between storage tanks and storage water heaters, and recirculation supply and return loop shall meet the following: 1. Insulation to be flush with pipe insulation or have minimum of one inch if appurtenance is bulkier. 2. Removable and re-installable for maintenance or replacement. 3. Pipe supports, hangers, and clamps shall be attached on the outside of rigid pipe insulation. c. All pipe insulation seams shall be sealed along the length of the pipe and between adjacent sections of insulation material. d. Insulation for pipe elbows shall be mitered, and insulation for tees shall be notched. Alternatively, tees and elbows may be pre-formed, or site fabricated with PVC covers. e. Isolation valves shall be fully functional. Extended stem isolation valves shall be installed on hot water piping or where pipe insulation is required.

K. Determination of Verification Compliance

All applicable sections of this document shall indicate compliance with the specified verification protocol requirements in order for this Certificate of Verification as a whole to be determined to be in compliance.

01	

VERIFIED MULTIFAMILY CENTRAL HOT WATER SYSTEM DISTRIBUTION

CALIFORNIA ENERGY COMMISSION

CEC-LMCV-PLB-21-H

SAMPLE FORM – NOT VALID FOR SUBMISSION TO BUILDING DEPARTMENTS

DOCUMENTATION AUTHOR'S DECLARATION STATEMENT

1. I certify that this Certificate of Installation documentation is accurate and complete.

Documentation Author Name:	Documentation Author Signature:
Company:	Date Signed:
Address:	CEA/AEA/ECC Certification Identification (If applicable):
City/State/Zip:	Phone:

RESPONSIBLE PERSON'S DECLARATION STATEMENT

I certify the following under penalty of perjury, under the laws of the State of California:

1. The information provided on this Certificate of Verification is true and correct.
2. I am the certified ECC Rater who performed the verification identified and reported on this Certificate of Verification (responsible rater).
3. The installed features, materials, components, manufactured devices, or system performance diagnostic results that require ECC verification identified on this Certificate of Verification comply with the applicable requirements in Reference Appendices RA2, RA3, and the requirements specified on the Certificate of Compliance for the building approved by the enforcement agency.
4. The information reported on applicable sections of the Certificate(s) of Installation (LMCI) signed and submitted by the person(s) responsible for the construction or installation conforms to the requirements specified on the Certificate(s) of Compliance (LMCC) approved by the enforcement agency.
5. I understand that a registered copy of this Certificate of Verification shall be posted, or made available with the building permit(s) issued for the building and shall be made available to the enforcement agency for all applicable inspections. I will take the necessary steps to fulfill this requirement.
6. I understand that a registered copy of this Certificate of Verification is required to be included with the documentation the builder provides to the building owner at occupancy. I will take the necessary steps to fulfill this requirement.

BUILDER OR INSTALLER INFORMATION AS SHOWN ON THE CERTIFICATE OF INSTALLATION

Company Name (Installing Subcontractor, General Contractor, or Builder/Owner):	
Responsible Builder or Installer Name:	CSLB License:

ECC PROVIDER DATA REGISTRY INFORMATION

Sample Group Number (if applicable):	Dwelling Test Status in Sample Group (if applicable):

ECC RATER INFORMATION

ECC Rater Company Name:	
Responsible Rater Name:	Responsible Rater Signature:
Responsible Rater Certification Number w/ this ECC Provider:	Date Signed:

For assistance or questions regarding the Energy Standards, contact the Energy Hotline at: 1-800-772-3300

LMCV-PLB-21-H User Instructions

A. General Information

This table reports the building location as specified on the Registered LMCC.

B. Design Verified Central Water Heating Systems Information

This table reports features of the water heating system other than HPWH system that were specified on the registered LMCC compliance document for this project. For information only and requires no user input.

B2. Design Verified CHPWH System Information

This table reports the water heating systems specified on the registered LMCC compliance document for this project.

C. Installed Verified Central Water Heating Systems Information

This table reports the water heating system information that is being installed. Require one line for each central system.

1. Water Heating System ID or Name – Reference information from LMCC.
2. Water Heating System Type – Reference information from LMCC. The different kinds of water heating system type are DHW or Combined Hydronic.
3. Water Heater Type – Information from LMCC. The different kinds of water heaters are Large/Commercial Storage, Small/Consumer Storage, Residential-Duty Commercial Storage, Heat Pump, Boiler, Large/Commercial Instantaneous, Small/Consumer Instantaneous, Residential-Duty Commercial Instantaneous or Indirect.
4. # of Water Heaters in system – Reference information from LMCC.
5. Water Heater Storage Volume (gal) – User input. Value may be N/A if water heater type is instantaneous with zero storage.
6. Fuel Type – Reference information from LMCC. The different kinds of fuel types are natural gas, propane, oil, or electricity.
7. Rated Input Type – Reference information from LMCC. For natural gas, propane and oil fuel type the input type is Btu/Hr. For electric the input type is kW.
8. Rated Input Value – User input. Numerical value of the rated input. Must be equal to or less than value indicated on the LMCC.
9. Heating Efficiency Type – Reference information from LMCC. Different efficiency types are AFUE, UEF and Thermal Efficiency.
10. Heating Efficiency Value – User input. Numerical value of the Heating Efficiency. Must be equal to or higher efficiency than value indicated on the LMCC
11. Standby Loss – User input. Must be equal to or less than value indicated on the LMCC. Value may be N/A if LMCC value is N/A.
12. Exterior Insul. R-Value – User input. Must be equal to or higher than value indicated on the LMCC. Value may be N/A if LMCC value is N/A.

C2. Installed Verified CHPWH System Information

This table reports the water heating system information that is being installed. Require one line for each installed water heater. Require one line for each installed water heater.

1. Water Heating System ID or Name – Reference information from Table B2.
2. Modeled Equipment Make and Model – User input must be equal to the value indicated on Table B2 as default and allow user to override with an equivalent system based on the simulated equipment in Table B2.
3. Number of Water Heaters/ Compressors – User input, must be equal to the value indicated on table B2.
4. Primary Tank Location – Reference information from Table B2.
5. Primary Tank Volume – User input, must be equal to or higher than the value indicated on table B2.
6. Primary Tank Insulation – User input, must be equal to or higher than value indicated on table B2.
7. Loop Tank Location – Reference information from Table B2.
8. Loop Tank Volume – User input, must be equal to or higher than the value indicated on table B2.
9. Loop Tank Insulation – User input, must be equal to or higher than value indicated on table B2.
10. Loop Pipe Insulation Thickness – User input, must be equal to or higher than the value indicated on table B2.
11. Loop Tank – Reference information from Table B2.

D. Design Verified Central Water Heating Distribution Systems Information

This table reports the water heating distribution types specified on the registered LMCC compliance document for this project.

E. Installed Verified Central Water Heating Distribution Systems Information

1. Central DHW System Distribution Type = Reference information from LMCC.
2. Dwelling Unit DHW System Distribution Type =- Reference information from LMCC.

F. Installed Verified Water Heater Manufacturer Information

This table reports the manufacturer information of the installed water heater(s). Require one line for each installed water heater.

1. Water Heating System ID or Name – Reference information from LMCC.
2. Manufacturer – User input. Enter the name of the water heater manufacturer.
3. Model Number – User input. Enter the model number of the water heater.

G. Mandatory Requirements for All Central Domestic Hot Water Recirculation Systems

This table lists the requirements for all central recirculation systems. Installer must ensure all the requirements in this table are met.

H. California Plumbing Code Appendix M

This table lists the requirements for California Plumbing Code Appendix M. ECC rater must ensure all the requirements in this table are met.

I. Verified Multiple Dwelling Units Master Mixing Valves Installation Requirements

This table lists the requirements for multiple Dwelling Units Master Mixing Valves. ECC rater must ensure all the requirements in this table are met.

J. Verified Pipe Insulation for Central System

This table lists the requirements for Verified Pipe Insulation for Central System. ECC rater must ensure all the requirements in this table are met.

K. Determination of Verification Compliance

1. This field is filled out automatically. Compliance requires that all individual criteria pass.

Documentation Declaration Statements

1. The person who prepared the LMCV will sign and complete the fields for their name, company (if applicable), address, phone number, certification information (if applicable), date and signature.
2. The person who is assuming responsibility for the project being built to comply with Title 24, Part 6, will complete the fields (if applicable) for their company, responsible builder or installer name, CSLB license number, sample group number, dwelling test status in sample group, ECC Rater company name, ECC Rater name, ECC Rater signature, ECC Rater certification number and date signed.