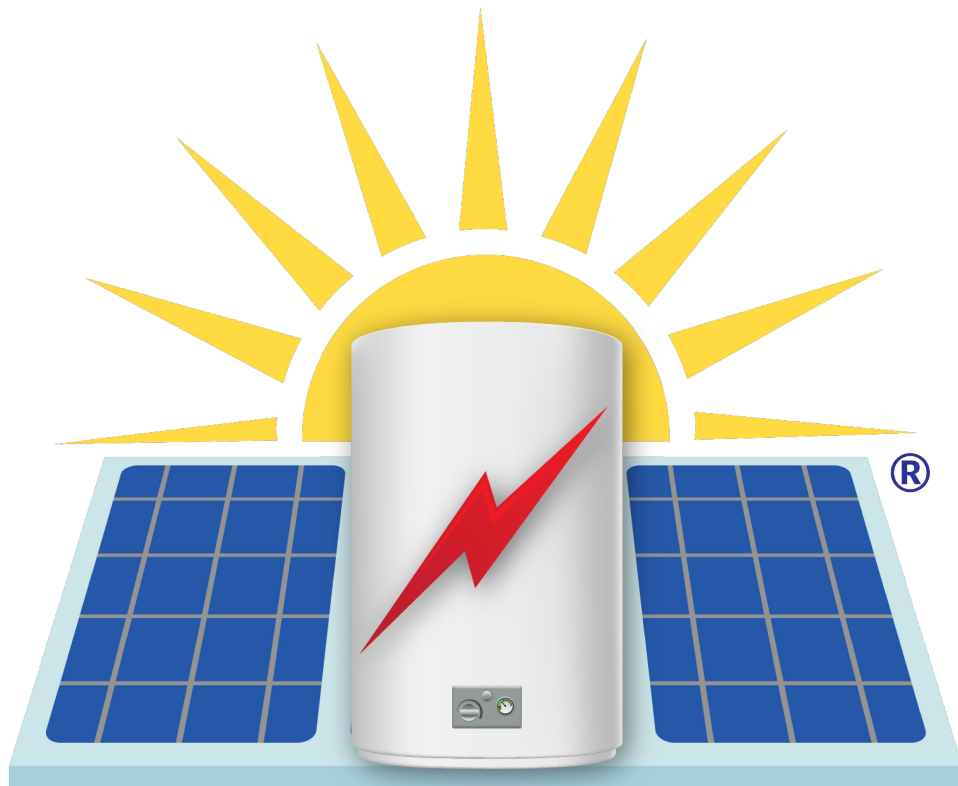




SETS[®]

Solar Electric Thermal Storage

Installation, operation and service instructions for SETS-80-1-HPTK



ICC-SRCC[™] Solar Heating and Cooling
Listing Number: SRCC-30004374

Exclusive Distributor
Sensible Technologies, Inc
4723 Tidewater Avenue • Oakland, CA 94601

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Delineation of tradesperson responsibilities:

1. Plumber, install per LG heat pump water heater manual.
2. Electrician wires 240/1 a) at the house main panel use a 30 amp breaker for the SETS control which also powers the LG HPWH, b) wire SETS control at the power "in" terminal block and wire outlet to the LG HPWH. c) Be sure to install local disconnect in line of sight to the LG HPWH, then from local disconnect to LG HPWH. For consistency, use 10 gauge wire; the black wire as L1, the red for L2, and green for ground.
3. Solar contractor or electrician wires one leg from PV disconnect, 'L1', through SETS control's sensor loop on the way to the house main panel. Or supply extra length 'L1' wire in the house main panel to be able to loop through the SETS control and back again to the house main panel. SETS is designed to work with Micro Inverters and String Inverters.
4. SETS system must have a minimum PV capacity of 2.8 KW.

Solar Electric Thermal Storage, SETS®

Welcome to SETS energy storage systems, especially relevant to California's Title 24 code compliance requirements. SETS is a single tank system that utilizes photo-voltaic panels to heat domestic hot water and stores that hot water in a super insulated heat pump water heater storage tank. When there is a demand for hot water heating while in the Hybrid or Auto Mode, the heat pump turns on and back-up heating element is in standby. The SETS high net solar fraction assures the most cost effective and valuable compliance option for all 16 California climate zones.

The SETS manual is a supplement to the LG Heat Pump Water Heater Manual. Installer must follow the manual for maximum performance and warranty.

CAUTION: Incorrect installation, service or operation can damage the water heater and other property. Risks are (but not limited to) fire, electrical shock, flooding, and scalding. Only a trained licensed professional should install SETS and only in accordance with local regulations and codes. All wiring in SETS is to be in accordance with the National Electrical Code and/or local regulations.

How SETS Works

The SETS (Solar Electric Thermal Storage) system is offered in a single tank domestic hot water heater. When the sun is shining, solar electricity generated from a photovoltaic (PV) solar system is diverted to a heat pump water heater heating the tank to 140°F from solar energy in most weather and demand conditions. When the sun goes down, the stored hot water is ready to go for evening use and usually for early morning use.

A tempering valve is field installed on the hot out of the heat pump and is set to 120F to prevent scalding. A temperature gauge is installed at the blend point to monitor the temperature and to dial in the set point appropriate for domestic hot water.

The SETS system utilizes both heat pump the 5.0 KW element of the heat pump water heater. SETS stores the solar hot water as a thermal battery. When the SETS heat pump tank reaches the 140°F set point during daylight hours, the SETS control turns off the power to the LG HPWH, so then all solar electricity is now diverted to other uses on site, to electric batteries, or back to the grid.

SRCC Values per Climate Zone

State of California			
Location*	Climate Zone (ASHRAE 169)	Annual Solar Fraction (SF _A)	Annual Energy Savings (kWh)
CCZ 1- Arcata	7	0.61	2705
CCZ 2 – Santa Rosa	6B	0.69	2941
CCZ 3 - Oakland	3C	0.72	3079
CCZ 4 – Sunnyvale	4C	0.77	3194
CCZ 5 – Santa Maria	5C	0.77	3263
CCZ 6 – Los Angeles	3B	0.81	3119
CCZ 7 – San Diego	3B	0.80	3087
CCZ 8 – El Toro	3B	0.81	3170
CCZ 9 – Burbank	3B	0.77	3033
CCZ 10 – Riverside	3B	0.80	3082
CCZ 11 – Red Bluff	3B	0.72	2798
CCZ 12 – Sacramento	3B	0.73	2906
CCZ 13 - Fresno	3B	0.75	2919
CCZ 14 – China Lake	3B	0.85	3135
CCZ 15 – El Centro	3B	0.85	2767
CCZ 16 – Mt. Shasta	7	0.70	3116

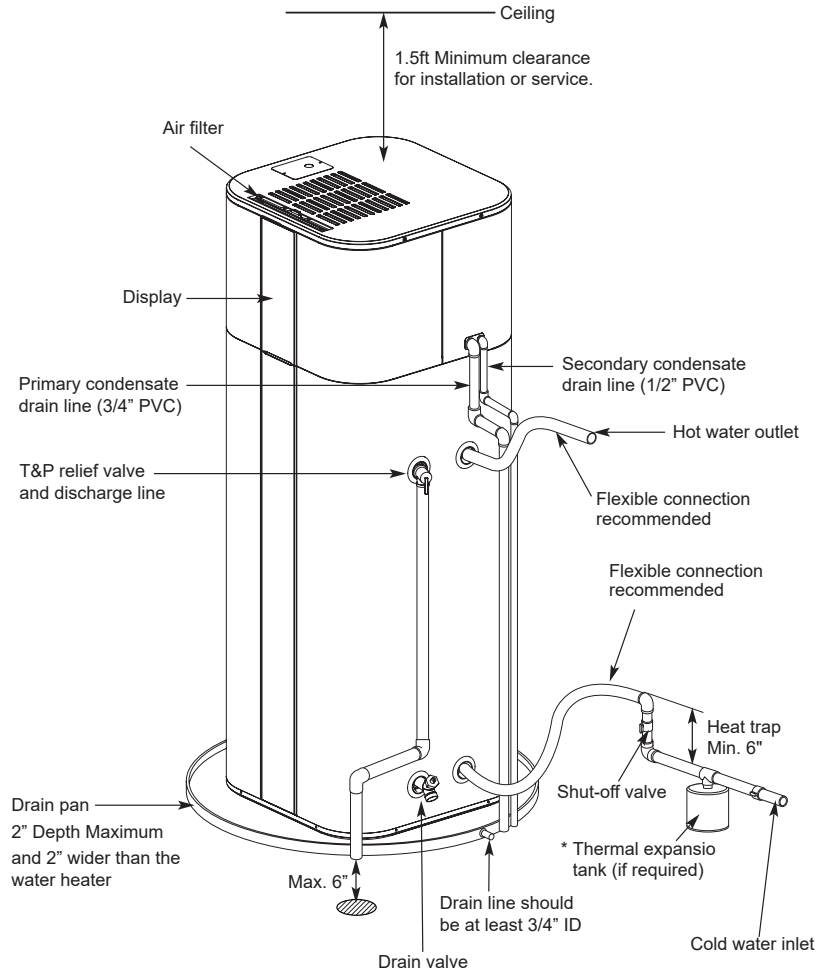
* California Building Climate Zones and representative cities are established by the California Energy Commission for use in the CA Title 24 Energy Efficiency Standards



Heat Pump Water Heater - 60 Hz (R134a)

14. Installation

Installation Instructions



* In closed system, connect a thermal expansion tank to cold water supply line

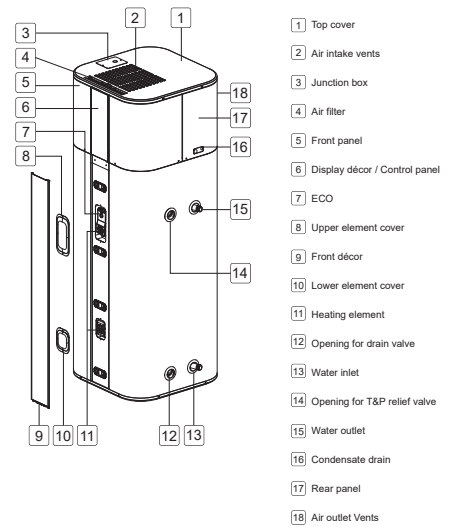


Heat Pump Water Heater - 60 Hz (R134a)

14. Installation

INSTALLATION

Parts and Functions



Product Description, Specifications, and Dimensional Information

SETS Components

LG HPWH 58 or 80 gallon Heat Pump electric tank

SETS Controller

ESBE ¾" tempering valve with thermometer

Elbi 5 gallon expansion tank

AquaMotion or Taco "On Demand", "On Call" domestic hot water recirculation pump.

SETS reserves the right to update the manual and components when necessary.

Model Number	Nominal Capacity	Rated Storage Volume	UEF	First Hour Rating (Gallons)	Dimensions in inches		Sound (Auto)	Approx dry ??? Weight (lbs)
					A	B	C	
LG APHWC501M	58 gallon	53 gallon	3.93	76	64"	23"	42 dBa	220
LG APHWC801M	80 gallon	72 gallon	3.9	92	79"	23"	42 dBa	262

The LG Heat Pump Water Heater is supplied with a 5000-Watt element. When the sun is shining, and the LG is running on heat pump only, the SETS contribution is 14 gallons per hour continuous recovery at a 60F. Recommended that the LH HP be set on Hybrid. This allows the heat pump to run most of the time but with a boost from the 5000 watt element. Note: The 5000 watt element at 240 volts makes 40.7 gph at a 60F rise. Another way of calculating rise is if we have a 60°F rise, the 80-gallon tank will be completely heated in 4 hours. The first hour rating at a 60°F rise is 55 gallons.

Since the SETS is a solar electric heat pump water heater, there is no combustion air required, no corrosive condensate, there is no natural or LP gas, and there are zero clearances to combustible materials (service clearances are still in force). So, the tank can be installed on a garage floor or on blocks with ¾" solid plywood. Follow local codes regarding strapping.

The LG HPWH requires 700 cubic feet of area if it uses the space around it for fresh air and exhaust air. See LG manual for additional details in ventilation. Often the cool outlet air is diverted outdoors or to a location which needs cooling.

Every water heater may eventually leak; whenever possible place water heater in an area that will not be damaged if there is a water leak. If the tank is located in an area where possible damage could occur, a drain pan must be installed with plumbing to the outside or drain per local codes.

SETS Control:

SETS control box can be installed adjacent to the electrical main or by the LG HPWH, where L1 (black) and L2 (red) from the main disconnect with 30 amp breaker connects to SETS control box, which also goes through a local disconnect line of sight to the LG HPWH, and is wired to the HPWH L1 (red) and L2 (black). Minimum 10 gauge THHN wire is to be used. The SETS box is NEMA4 rated, so it can be installed exposed to weather.

The SETS control box is dimensionally as measured at the rear of the box: 10-1/4" wide x 12-3/8" x 7" deep. It includes relays, sensor, pre-wired and labeled terminal strips. It will also bear the UL label 508A.

Special note to PV Installer: L1 wire from PV disconnect box must pass through SETS control box and pass-through sensor loop inside SETS control "AS-1" on its way to the main control panel.

Recommended optional components:

- “On Call” domestic hot water recirculation pump.
- Elbi DXT-18, 5-gallon expansion tank.
- Temperature and pressure gauges, standard 3/4” ball valves and check valves. Larger sized valves or fitting connections are available upon request at additional cost .
- Plumber to supply all necessary tubing, fitting, pipe insulation (R-4) for a complete job.



NO.1 IN HYDRONIC SYSTEM CONTROL

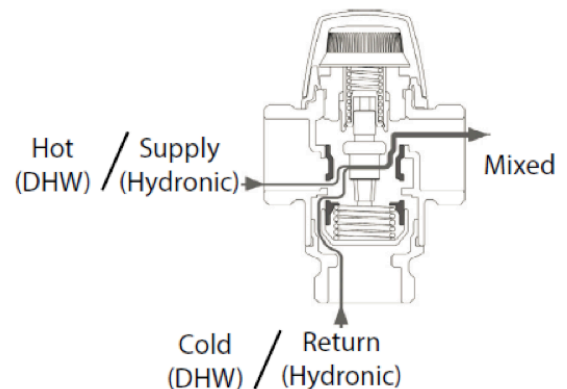
ESBE Tempering valve, VTA 3/4”, FPT

Tempering valve, ESBE VTA 3/4”, FPT. Install per SETS drawing(s). The tempering valve ships with a temperature gauge. When the domestic hot water system is fully functional, and a hot water fixture such as kitchen faucet is open to hot water, the final detail when commissioning the system is dialing in the tempering valve. Best practices is to install a temperature gauge on the outlet of the tempering valve. So when commissioning the hot water system one can look at the temperature gauge on the outlet of the tempering valve and make adjustments.

If the temperature is above 120°F, remove the tempering valve’s cap. This cap is tamper-resistant, but can be pried off to make adjustments. Remove the cap, and turn the knob clockwise to reduce the temperature. Watch the gauge as you do this until you get the desired temperature.

Then replace knob back in the locked position and screw it back together. If you need higher temperatures, turn the knob on the counterclockwise side, until you get the desired temperature.

Flow Pattern:



The AquaMotion AMH2K-7N and AMH2K-RN

The AquaMotion AMH2K-7N for up to 200’ recirc loop, or the AMH2K-RN for up to 600’ recirculation loop.

Given the importance of water conservation, an “On Call” domestic hot water system should be a feature of most residential applications. For example, a 25’ run of 3/4” type L copper contains 1/2 gallon of water would have to be dumped before warm water arrives at a fixture if a AquaMotion recirc pump isn’t used. When used, the AquaMotion AMH2K-RN “On Call” recirculation pump must be installed per drawing in the SETS manual. This allows the preheated water in the SETS to be moved to the primary heater every time the pump turns on. AMK-WB “On Call” wireless receiver. It plugs into a receptacle, and the AMH2K recirculation pump plugs into the AMK-WB receiver. WB wireless buttons or motions sensor to activate domestic hot water.

When starting up the SETS system, leave the “On Call” pump unplugged for at least 24 hours after the solar PV system has been connected and is operational. This will allow the SETS tank to get up to temperature, otherwise, the “On Call” will run continuously during initialization until the aquastat gets up to 105°F or more to turn off the pump.



Elbi expansion tank

Install Elbi DTX18 as indicated on SETS drawing. The bottom of the DXT there is a Schrader valve. Set the DXT tank pressure to be at or slightly above the entering water pressure (with an air compressor or bicycle pump), before applying water pressure to tank. If you have applied water pressure to the plumbing side of the DXT, isolate the DXT and remove it from the plumbing line, then test the Schrader valve. Apply or let air out as necessary.

All modern homes have a check valve installed on the cold-water inlet to prevent back flow into the city water supply, so per the UPC an expansion tank such as the Elbi DXT-18 five-gallon expansion tank must be installed on the cold-water inlet to the LG tank.

Warranty

1. For the Heat Pump water heater warranty see LG warranty. LG limited warranty in summary is 10 years warranty against tank leakage and compressor failure, and 1 year parts warranty. Contact installing contractor and/or tank manufacturer as seen on tank rating plate. SETS Control has a 1 year limited parts warranty. Contact your installing contractor or SETS distributor, 800-786-6847. Not responsible for element damage if broken by hard water or dry fire (water heater must be purged of air and full of water before applying power to SETS control). See maintenance procedures.

Troubleshooting

1. The first operational check is making sure the disconnects are on at the main breaker and locally at the Solar PV, water heater and SETS disconnects. Second making sure the solar PV is operational. Remember the SETS system only heats the water during daylight hours when sufficient sun is on the PV collectors.

Use a volt/ohm meter to check the power going to the bottom element and ohms. It should read around 208-240 volts ac. The LG uses a 5 KW element, so the ohms resistance should test around 9.68 ohms with the power off. If the element is broken, the ohms will read zero, even while the volts read 240. If the element is broken, it must be replaced with same sized element. Follow tank manufacture's procedure on replacing element.

2. To shut down the SETS system, simply turn off power at the local disconnect or the disconnect at the main panel. All power generated by the PV system will be automatically directed to the main panel to be used locally or back to the grid. Normally, there is no need to turn off the SETS system, it is safe to leave unattended. The internal SETS relays are in the normally closed position for when the SETS is off, that is, the sun has set, and standard grid power supplies the LG HPWH.
3. Common repairs are cleaning or replacing the electrical element in the bottom of the tank. Less common would be replacing the relays in the SETS control. See LG manual for their maintenance procedure.
4. Maintaining performance of the SETS system is the maintenance of the solar PV system. Clean the collector array at least twice a year. See PV manufacturer's instructions, but they usually include spraying off the array with water, then scrub down with soapy water such as Dawn, then rinse off. The second is cleaning the element. In hard water areas, this is done every 6 months by removing the element and soaking the element in vinegar- water mixture for several hours to dissolve the sediments off the element. In soft water areas, annual inspection and possible cleaning is required to maintain the life of the element. There is no maintenance required for the rest of the SETS system.

LEGEND		KEY NOTES
	BALL VALVE	1 PROVIDE TEMPERATURE & PRESSURE RELIEF WITH DIRECT PIPING TO APPROVED LOCATION. 2 HEATPUMP CONDENSATE TO DRAIN 3 RECIRCULATION PUMP WITH DEMAND PER T-24 REQUIREMENTS, AQUAMOTION AMH2K-7N AND RECEIVER AND MOTION SENSOR OR EQUAL. COORDINATE WITH PLUMBING CONTRACTOR AND SIZE BASED ON PLUMBING DESIGN. 4 VERIFY WITH LOCAL AUTHORITY HAVING JURISDICTION FOR BACKFLOW PREVENTION REQUIREMENTS. 5 WIRE PV POWER L1 THROUGH LOOP IN SETS CONTROLLER. LOCAL DISCONNECT. SHOULD BE 20 AMP 6 PROVIDE DRAIN PAN UNDER EACH WATER HEATER
	PRESSURE GAUGE	
	TEMPERATURE GAUGE	
	THERMOSTATIC MIXING VALVE	
	UNION	
	HOSE BIB/DRAIN/ PURGE VALVE	
	CHECK VALVE - SPRING	
	TEMPERATURE PRESSURE RELIEF VALVE	
	EXPANSION TANK	

