



Direct System

Owner's Manual

Table of Contents

A/C vrs D/C-pv Systems.....	3
General Information	3
Theory of Operation	4
Safety Devices.....	4
Checking Your System's Operation	4
Operating Suggestions	4
Routine Maintenance	5
Emergency Procedures (Drain and Fill Collectors)	5-6
Be Aware of Cool, Clear, Calm Nights.....	6
The Collector.....	6
The Solar Storage Unit.....	7
The Valves on the Tank.....	7-8
The Valves on the Collector.....	8-9
Freeze Protection	9
Trouble Shooting	9
Diagram	10
Warranty.....	11

This owner's installation manual includes owner's installation and operation instructions for both A/C (alternating current powered) and D/C-pv (direct current powered photovoltaic powered) systems. Generally, most information included applies to both types of installations; however, when instructions vary between the two systems it is duly noted as such. So, first, determine which system you have, then follow instructions for that system only when two different set of instructions are shown.

My System is: A/C _____ or D/C pv _____

CONGRATULATIONS ON YOUR DECISION

You have just invested in one of the finest energy-efficient home appliances available today. Your new Solar Water Heating System uses only the highest quality materials and workmanship, assuring you many years of dependable service.

Your benefits are just beginning, so enjoy the comfort of not just knowing that your utility costs will be reduced, but also that you now own your own small utility company - you have hot, hot water "free" from the sun. Your solar water heater is truly "the world's most energy-efficient home appliance," and is a positive statement from you to the whole world that it is time to use products that are environmentally friendly, safe, and non-polluting. Your system is also a clean energy source which helps reduce our nation's dependence on foreign oil.

We would like to thank you for making a truly positive contribution to our global environment, future posterity, and for placing your confidence in our organization and product.

This manual has been prepared to answer questions about the operation, maintenance, and service of your solar system. Should you have any questions, or if we can be of service to you in the future, please feel free to contact us.

STANDARD REQUIRMENTS AND WARRANTY

The solar systems described in this manual, when properly installed and maintained, meet the minimum standards established by the Florida Solar Energy Center in accordance with Section 377.705 of the Florida Statutes. This certification does not imply endorsement or warranty of this product by the Florida Solar Energy Center or the State of Florida. We specifically exclude any warranty for, or liability from acts of nature, including freeze damage and shading of the collector (s) by future growth.

MANUFACTURER/MODEL

COLLECTOR MODEL#: _____

CONTROLLER: _____

TANK MODEL #: _____

PUMP MODEL #: _____

SYSTEM MODEL #: _____

All The LeverEdge complete prefabricated solar water heating systems comply with the new requirement of a weighted average maximum of 0.25% lead.

THEORY OF OPERATION

In the morning between approximately 9:00 – 10:00 A.M., sufficient amounts of heat are produced to cause the pump to start circulating. The pump will then draw the coldest water from the bottom of the tank, passing it through the collector and adding 10-15 degrees per hour to the temperature of the water.

As the sun rises during the day, the amount of heat available to the thermal collector increases, causing an increase in temperature and in the flow of water through the solar system. The water is then returned to the bottom of the tank. This heated water will gradually rise to seek a level consistent with its temperature. The process will continue throughout the solar day until all of the water in the tank has been heated by the sun, if available sunlight exists.

With the combination of both the electric and solar, you will have an abundance of hot water with a minimal amount of electricity being consumed from conventional sources. Your system is designed to produce between 70% - 90% of your total hot water needs on an annual basis. Many times during the year it is possible to completely disconnect the backup element by tripping the circuit breaker or unplugging the unit (water heater) – thereby producing 100% of your energy requirements from solar.

If the solar system is unable to heat the water to the desired temperature – Example: Water is 130 degrees when the desired temperature is 140 degrees – the backup element will be forced to come on, adding only 10 degrees of heat to the system, instead of the typical 60-70 degrees that may be required to bring the temperature up to the desired 140 degrees.

SAFETY DEVICES

Your system includes several protective devices. There is a temperature/pressure relief valve on the top of the tank and an additional pressure relief valve in the “solar loop”, normally at the top of the collector. Your collector acts as a fixed hi-limit temperature protection device. Both A/C and D/C-pv systems can be equipped with adjustable hi-limit temperature protection.

Normally you should leave your system alone and plugged into the backup element. There is virtually no maintenance other than periodic draining of the tank and back flushing of your collector(s). (See Routine Maintenance Section)

CHECKING YOUR SYSTEM'S OPERATION

Your solar system will usually begin collecting heated water by 9:00 to 10:00 in the morning. The start time may vary according to weather conditions that given day.

1. The water returning from the collector is 3-10 degrees greater than the water going up the pipe located on the pump or feed side. This can be checked by temperature gauges or by feeling the pipes to see if there is a temperature difference.
2. The pump emits a soft humming sound. This sound is normal and indicates that water is circulating.
3. The normal “solar window” is 3-3 1/2 hours before and after “solar noon” (the time when the sun is directly overhead). It is during these hours that any testing of the system should be done. Please note that “solar noon” rarely occurs at 12 noon.

OPERATING SUGGESTIONS

Your solar hot water system is designed to provide hot water for a minimum of 70% of your yearly hot water needs. Listed below are some suggestions that you can follow to keep your system operating at peak performance and save hot water.

1. **ANNUAL INSPECTION:** We recommend a 20-point annual check-out and inspection be done by our certified service department which could also cover most routine maintenance. Call to see at what time of year this service is available in your area.
2. **FLUSH TANK:** Located at the bottom of the tank is a manual drain. This valve is used for the purpose of draining water out of the tank and flushing the tank periodically.
At least once per year, you should flush you tank for approximately 10-15 minutes to remove any sediment that may have accumulated on the bottom of the tank. This flushing process will cause a greater degree of efficiency and extend the life of your system, (See Routine Maintenance Section).
3. **BACK FLUSH COLLECTORS:** See “Routine Maintenance” Section - No. 2. on page 5.
4. **DISHWASHING:** This should be done during the day. We recommend washing dishes between 2:00 P.M. and 4:00 P.M.
5. **WASHING:** Try to spread your clothes washing over several days instead of washing all your clothes the same day at the same time.
6. **SINGLE LEVER FAUCETS:** Make sure that when the cold water faucet is **turned “on”** that the faucet lever is all the way over in the cold position. This prevents hot water from flowing from the storage tank and being wasted.

ROUTINE MAINTENANCE

ANNUAL INSPECTION – We recommend a 20-point annual check-out and inspection be done by our certified service department which could also cover most routine maintenance. Call to see at what time of the year this service is available in your area.

However, if you choose to maintain your system yourself, do the following:

1. The hot water tank should be flushed of sediment at least once per year. Follow the instructions which come with the tank. Change the anode rod every three to four years. The life of the tank will be extended considerably if this is carried out!
2. The collector along with the feed and return lines should be flushed at least once per year. Sediment builds up on the internal surfaces from the slow circulation. Follow the steps listed below to flush and **refer to the illustration on page 10** to locate numbered items.
 - A. Connect a garden hose to the drain valve (14) with the appropriate end going into a sewer drain or outside.
 - B. Close valve (13).
 - C. Open valve (14) all the way.
 - D. Observe water exiting hose. Close valve (14) when the water runs clear. (This process normally takes 1-2 minutes.)
 - E. Open valve (13). F. Remove hose.
3. Collectors will usually wash themselves in the rain. If rainfall is not sufficient for cleaning, any mild detergent can be used on the glass. Use a soft brush or cloth to clean the glass. **DO NOT** pour cold water on the hot glass.

EMERGENCY PROCEDURE

1. Turn pump OFF:

If A/C, unplug Controller (2) 110 Volt from wall or unplug Pump (7) 110 Volt from Controller.

If D/C-pv, remove one wire nut from wire to pump, cap each end individually with wire nut or electrical tape. Remember, remove wire nuts "only" on D/C-pv pumps.

(The above methods will shut down the electrical portion of the solar system.)

2. Close valve (8) and (13) if a leak should develop in the solar system. NOTE: Water coming off roof in cold weather is normal. Place a bucket under drain valves (14) and (9), open these two valves, and leave open.
3. Close valve (5) if problems arise in the tank or hot water system.
4. Be sure to turn backup heating element "OFF" before draining tank. Element will burn out if left "ON" when the tank is empty.
5. Call for service.

TO DRAIN THE COLLECTOR

1. Shut down electrical portion of solar system per STEP 1 under "EMERGENCY PROCEDURE" above.
2. Close valves (8) and (13).
3. Place bucket under drain valves (14) and (9).
4. Open drain valves (14) and (9).
5. Do not close valves (14) and (9).
6. Check collector area for other drain valve(s) on the roof. (See note on page 9 under Freeze Protection: 1. Manual Drain Down.) Open all such drain valves.

7. To help remove trapped water in the collector before freezing conditions occur, you may drain the collector 2-3 days prior to the expected freeze to “steam” away most of the trapped water in the collector. Also, you can blow with your mouth on valve (14) while holding one hand over valve (9) until the pressure builds up, then release the pressure on valve (9). This should remove water trapped in the collector. However, none of these methods is 100% effective in removing all the water.

TO START UP SYSTEM AFTER DRAIN DOWN

1. Close the drain valve(s) on the roof.
2. Attach a hose to drain valve (14) with opposite end going to the outside or a sewer drain.
3. Close drain valve (9).
4. Open valve (8).
5. Wait one minute then close valve (14) and remove hose.
6. Open valve (13).
7. START UP electrical portion of solar system by reversing STEP 1 under “EMERGENCY PROCEDURE” above.

BE AWARE OF COOL, CLEAR, CALM NIGHTS

Solar collectors are not only good absorbers of radiant heat, but are also good radiators of it. When the temperature drops to 40 degrees Fahrenheit and there is no wind or cloud cover, your solar collector could actually freeze even though the temperature does not indicate freezing. This happens because the collector radiates heat away from the water instead of retaining the heat. If the cool, calm, clear conditions persist long enough – enough heat could be lost to lower the water temperature to freezing or below.

Freezing temperatures are infrequent occurrences in Central and South Florida, but you need to be aware of the potential hazard. If the conditions described above seem imminent, complete draining of the collector (s) of all water is the only positive assurance against freeze damage. It has been our experience, though, that the incidence of damage is much greater when inexperienced individuals attempt to drain collector (s) rather than allowing our designed features to take over. Nearly all solar systems are covered by home owner’s insurance. This fact, in addition to the low failure rate due to freeze, means that our general recommendation is to let the system operate untouched.

We hesitate, in a specific circumstance, to recommend what you should do with your solar system. However, we suggest that homeowners not attempt to improve on the system’s designed features.

THE COLLECTOR

Your solar hot water unit is equipped with one of the finest collectors available on the market today. It consists of copper flow tubes attached to a flat deck absorber plate, which creates a highly-efficient heat transfer mechanism from the absorber plate to the flow tubes.

The absorber plate for your system is enclosed in an extremely durable housing, which is completely insulated on the bottom and on the sides with high R-value insulation. This insulates the collector from the cool outside air, allowing for a high degree of efficiency.

The collector’s surface is covered with a special tempered glass designed specifically for solar collectors, which permits a high percentage of the solar energy available to penetrate the glass and make contact with the absorber plate. This creates a “Greenhouse Effect” which traps the sun’s rays inside the collector so that they may be absorbed by the plate and transferred to the water.

THE SOLAR STORAGE UNIT

Your solar storage unit is either an 80 or 120-gallon model, depending on the size of your family and the system which you purchased. All models are a tank within a tank, the outer tank being a light sheet metal cover that is painted and finished to look like other appliances – the inner tank is a high-pressure steel storage vessel.

The tank is lined with 1 ½" – 2" of high R-value foam insulation. This material provides the highest insulating coefficients available on the market today.

Unlike your normal water heater, your solar storage unit is a super insulated tank designed for minimum heat loss overnight and maximum efficiency. During normal operation without any use of hot water, your solar storage unit should not lose more than 2 degrees per hour.

The solar storage unit differs from an ordinary water heater in other ways. For example – it has 4-5 outlets on the top, instead of the normal 2-3 outlets that a typical electric water heater would have. This is necessary to make a "solar loop," as it is commonly called, referring to the pipes that connect the storage unit to the collector.

Located near the tank you will find the pump which circulates the water from the bottom of the storage tank up through the collector. This pump is connected to the tank by a dip tube, which is very similar to a straw, and draws water from the bottom of the storage unit – thereby capturing the coldest water available. You will also note the return line from the solar collector enters at the top of the tank through the combination back-flush valve/manual drain but terminates in the lower portion of the tank.

Your new solar storage unit is fed from the existing cold water inlet which your old electric tank used. This water enters through the top of the tank through another dip tube, and is discharged at the very bottom of the tank. The hot water is drawn off the top of the tank, as there is no dip tube on the hot water outlet side that feeds hot water to your house.

When hot water is demanded it will come from the very top of the tank (which is your hottest water) and will be resupplied with cold water at the very bottom of the tank, causing the hot water to gradually rise to the top of the tank until all of the hot water is depleted. Equal amounts of cold water will enter the storage tank in proportion to the amount of hot water leaving the tank.

Unlike a typical water heater, your solar storage unit is equipped with a single electric element – your old heater had two electric elements (one at the top and one at the bottom of the tank). Your solar unit, however, has an element located approximately 1/3 of the way down from the top of the tank. By having only one electric element your solar storage unit is able to heat electrically approximately thirty gallons of water. This, in essence, gives you the equivalent of a 30-gallon electric tank and 50/80 gallon solar storage tank. Thirty gallons of hot water should be sufficient for two normal showers. The system can then recover in about one hour in the same manner that a standard electric water heater would.

RESET BUTTON: THERE IS A THERMOSTAT CONTROL ALSO LOCATED APPROXIMATELY 1/3 DOWN FROM THE TOP OF THE TANK WHICH IS SIMILAR TO THE THERMOSTAT ON AN ELECTRIC WATER HEATER. BEFORE ADJUSTING THE THERMOSTAT AND REMOVING THE COVER PLATE OVER THE THERMOSTAT, YOU MUST EITHER UNPLUG THE ELECTRIC BACKUP OR TRIP THE CIRCUIT BREAKER IN THE HOUSE, WHICH WILL REMOVE ANY ELECTRICITY TO THE UNIT. NOTE: A THERMOSTAT RESET BUTTON (RED AND ROUND) IS LOCATED AT THE TOP PORTION OF THE THERMOSTAT. PUSH THIS BUTTON IN IF NO HOT WATER IS AVAILABLE WHEN THE ELECTRIC BACKUP IS ON. TURN OFF ELECTRICITY FIRST.

It is recommended that after removing the cover plate you make small incremental adjustments until you obtain the desired temperature, i.e. - make one notch either hotter or colder each day until the backup element heats the water to the desired temperature. (Should you have an electric dishwasher; we recommend that the backup temperature be set at 140 degrees.) The lower the temperature is set, the less often the backup element will come on, and you will, therefore, use less electricity.

THE VALVES ON TANK

1. COLD WATER INLET VALVE (Color coded blue)

Beginning with the cold water inlet, there is a conventional gate valve which allows you to shut off all the water to the tank. This is an EMERGENCY SHUTOFF VALVE – in the event that there is a leak in either the tank or the associated hot water plumbing in your house. Closing this valve isolates both the storage unit and the collector loop from its cold water supply.

2. ANTI-THERMOSYPHON VALVE/MOTORIZED BALL VALVE (A/C Only)/CHECK VALVE

Located directly below the manual drain (back flush valve) on the return line is a single valve, often called a motorized ball valve, check valve, or anti-thermosyphon valve. This valve allows water to flow freely as it is being pumped by the pump, circulating the water in the **forward** direction through the collector, through the solar return line, and back to the solar storage tank. This valve is designed to prevent water from flowing in the opposite direction. How? When the pump stops, this anti-thermosyphon valve automatically closes, which prevents the hot water in the solar storage tank from traveling backwards up into the solar collector where it would be dramatically cooled by the night air, then fall back into the tank.

This **reverse** cycling of hot water, thermosyphoning, would occur almost every night so a more expensive anti-thermosyphon valve is used to virtually eliminate this occurrence.

3. TEMPERATURE/PRESSURE RELIEF VALVE

Located on the top center line of the tank is a valve approximately 2" long. This valve is a **temperature/pressure (T&P) relief valve**. Its purpose is to protect your system in the event that it overheats, or for some reason pressure builds up in the tank beyond 150 lbs. per square inch. Anytime the water temperature reaches 210 degrees, this valve will open and discharge the hot water in your system until the water in contact with this valve reaches approximately 150 degrees, at which time it will close.

The normal position for the ball or isolation valve is open. This allows water to flow from the tank up through the collector and from the collector back into the storage tank.

4. ISOLATION OR BALL VALVES (Color coded blue for cold and red for hot)

The ball valves can be identified by a 3" lever located on top of the tank. The valve handles can be turned from the vertical position, i.e. – parallel to the pipes, to the horizontal position, i.e. – perpendicular to the pipes. The **perpendicular** position is the **closed position**. When the valve handles are **parallel** to the pipes, they are in the **open position**. (See On/Off arrows on handles.) These ball or isolation valves are used primarily for the purpose of isolating the collector (s) loop in emergencies and to drain the Collector (s).

The normal position for the ball or isolation valve is **open**. This allows water to flow from the tank up through the collector and from the collector back into the storage tank.

5. DRAIN VALVES (Color coded blue for cold and red for hot)

Directly above the ball valves you will find boiler drains. These drains are similar to the spigot you have on the outside of your house for your garden hose, (Opening these valves will allow water to be drained or flushed from the "solar loop" through a garden hose or into a vessel.) The normal position for these drain valves is **closed**. They are opened (twisted counter clockwise) when the supply and return lines to the collector are drained.

NOTE: Color Codes for valves are RED for Hot and Blue for Cold.

THE VALVES ON COLLECTOR

You will notice that on the top of the collector between the hot water outlet and the area where the pipe penetrates your roof, there is a manifold that is approximately one-foot-long which contains two or three valves. These valves are as follows:

1. AUTOMATIC AIR VENT

This valve allows any trapped air in the solar collector to discharge through the top of this valve, eliminating air buildup in the collector.

2. PRESSURE (only) RELIEF VALVE

This valve allows the system to discharge in the event that the pressure builds up in excess of 125 lbs. per square inch. This valve can be located elsewhere in the "solar loop".

3. FREEZE VALVE

This valve is designed to protect your system in the event that you fail to drain the system and the temperature drops below approximately 45 degrees. This valve will then open, discharging water on your roof at about one-fifth of a gallon per minute. As you remember, earlier in this manual we discussed the anti-thermosyphon, motorized ball, check valve. This valve causes the water to flow through the panel and out the freeze valve – thereby protecting your system from freeze.

IT MUST BE NOTED, HOWEVER, THAT THIS FREEZE VALVE IS A SECONDARY VALVE, AND IN THE EVENT THAT THE TEMPERATURE IS EXPECTED TO DROP BELOW 38 DEGREES ON A CLEAR, COOL NIGHT, THE SYSTEM CAN BE MANUALLY DRAINED. (See "Be Aware of Cool, Clear, Calm Nights" Section - page 6)

If you do not drain the system under these conditions, you will note water running off your roof periodically, (This is from the freeze valve opening and you will actually be able to hear the water running through the system in small quantities.

4. DRAIN VALVES

If the collector on the roof cannot be drained at the tank, there will be a drain valve or valves on the roof. This valve (s) must be opened in addition to following the manual drain down instructions.

FREEZE PROTECTION

Manual drain down is standard on all systems. Other systems include freeze protection valve (s). Although the system is designed to be completely automatic, some owners with larger systems prefer to turn their backup heating element off during the summer months. If you do this, remember to have the backup element ON from late November through February. Should a cold snap occur, and the backup element is OFF, the solar portion of the system could freeze and rupture. So, during the colder months leave the backup heating element on.

1. Manual Drain Down: See "To Drain Collector" pages 5 and 6.

NOTE: If collectors cannot be manually drained from above the tank, there is a **drain valve** (boiler drain) located on the lower side of the collector on the roof. **This valve must be opened in addition to** following manual drain down instructions.

2. Freeze Protection Valve (FPV): This valve is normally installed in all Central and South Florida locations. The freeze protection valve located on the roof will open at approximately 45 degrees Fahrenheit and automatically close at about 55 degrees Fahrenheit. This allows cold (60-70 degrees) tap water to keep the collector tubes from freezing while using lesser amounts of warm water (electrically heated). If you ever lived "up north" and were afraid your water pipes would freeze, you simply cracked a faucet or two to keep the water circulating (dripping) so freezing would not occur. The Freeze Protection Valve (FPV) does exactly the same thing as an open faucet except it opens and closes automatically.

NOTE: DO NOT BE OVERLY CONCERNED IF THE FPV IS OPEN (WATER RUNNING OFF ROOF) FOR A COUPLE OF HOURS AFTER THE SUN STRIKES THE COLLECTOR. THIS IS NORMAL. HOWEVER, IF IT CONTINUES, PLEASE CALL OUR SERVICE DEPARTMENT.

NOTE: Ice on the roof is a good sign. Do Not Close System Down if ICE is on Roof and Water is Dripping Down. This is usually normal. You will know later in the day if something is frozen because water will come off the roof in **great** quantities in a strong stream.

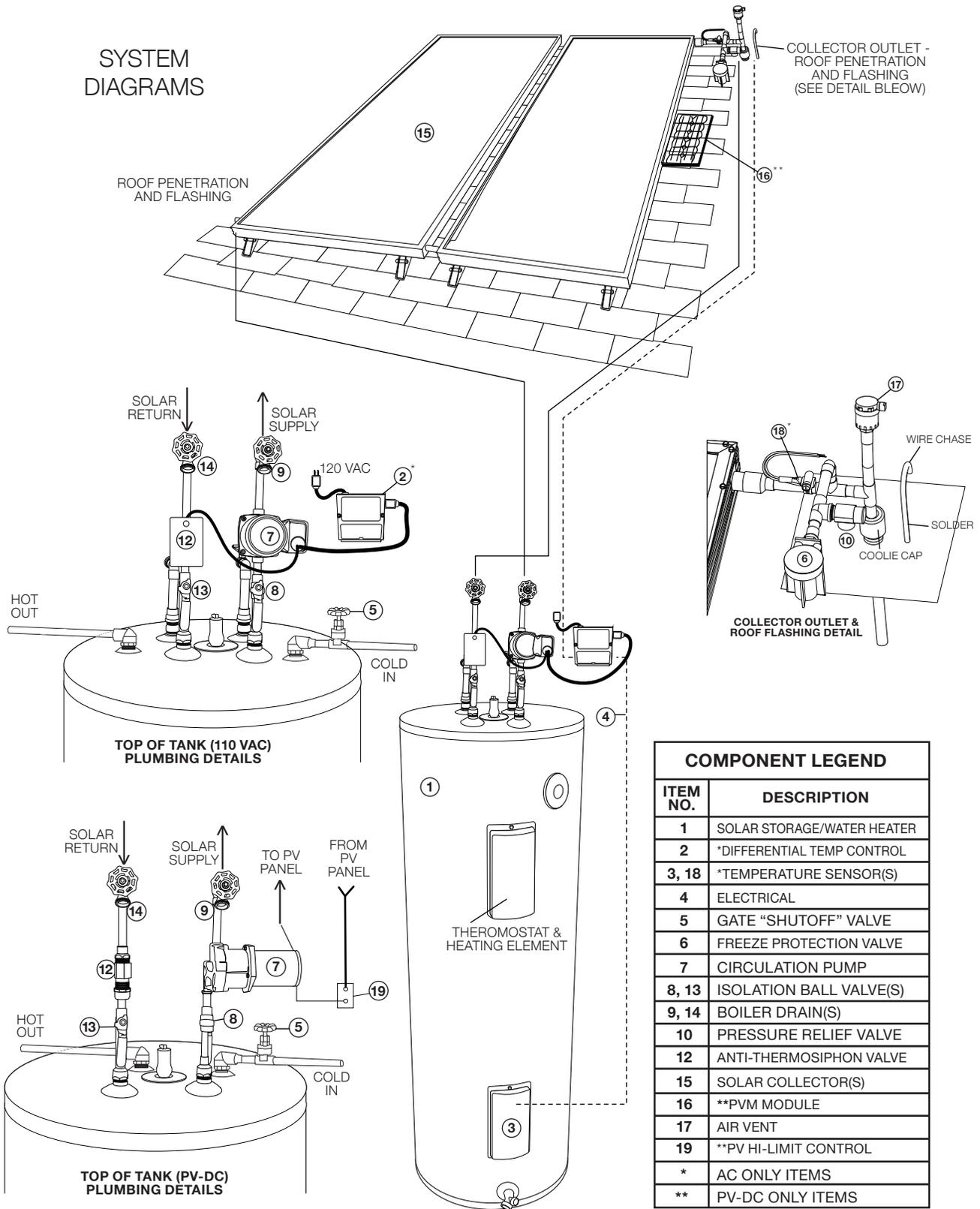
Troubleshooting

PROBLEM	POSSIBLE CAUSE	REMEDY
Insufficient Hot Water	Insufficient Solar Energy Excessive use of Hot Water Auxiliary Thermostat Malfunction	Use Backup Heating Element Use Backup Heating Element Push Reset Button (page 7)
Pump Never Runs - Day or Night	Controller in "OFF" Position Controller Unplugged Power not Available	Turn to "AUTO" Plug in Check Circuit Breaker/PV Panel
Pump Always Runs - Day and Night	Controller in "ON" Position Controller Malfunction	Turn to "AUTO" Call for Service
Hot Water at Night - None in the Morning	Insufficient Solar Energy Hot Water Used Up Freeze Valve Operation	Use Backup Use Backup Use Backup

Note: Most people leave the backup element on from late November through February.

SOLAR WATER HEATING SYSTEM

SYSTEM DIAGRAMS



Guardian Solar Water Heater Limited Warranty



The LeverEdge (hereinafter LE) warrants any Guardian brand solar water heater installed by a duly authorized Guardian dealer, to be free from defects in materials and workmanship to the original residential purchaser (hereinafter CONSUMER) from the date of purchase. All aspects of this Warranty are subject to the following limitations, terms and conditions.

1. DURATION OF WARRANTY

If a Guardian solar water heater component (hereinafter "Equipment") is determined by LE to have a defect in material or workmanship, LE will, at its sole discretion, repair or replace the defective part at NO CHARGE to the CONSUMER, excluding labor and applicable shipping costs, according to the following time allowances beginning with the date of installation (except for the Automatic Controller, for which time allowances begin from the date of manufacture):

The Solar Collector:	10 Years
The Water Heater:	6 Years
The Automatic Controller:	3 Years
Remaining Parts of the System:	1 Year

2. LIMITATIONS OF COVERAGE

This Warranty extends only to the CONSUMER for damage resulting from defects in materials and workmanship, and does not include renewable components. It does not extend to damage caused by the CONSUMER'S neglect or abuse, or by accident, to damage caused by wind, hail or abnormal weather conditions, or to damage caused by acts of God, civil insurrection or extraordinary circumstances beyond the control of LE.

LE shall not be liable for any direct or indirect damage resulting from the use of the Equipment, and in no event shall the extent of this Warranty coverage exceed the purchase price of the Equipment.

LE cannot know the circumstances that may affect the performance of a CONSUMER'S Guardian solar water heater. Numerous variables may be in effect for which LE has no control. LE makes no statements, assurances, promises, or guarantees, and assumes no liability regarding Guardian's performance for a particular CONSUMER, nor for a percentage of hot water provided, nor for reduction in a CONSUMER'S electricity usage or costs. LE does not authorize others to assume such obligations on its behalf.

This Warranty excludes any Equipment which was not installed by an authorized Guardian dealer or on which the date code has been removed or altered. Any tampering or attempted repairs performed by anyone other than an authorized dealer, including you, the CONSUMER, will void this Warranty.

3. MISCELLANEOUS

In order to be considered for validation, all Warranty claims must be accompanied by a copy of the purchase agreement indicating the date of initial installation, and a copy of the CONSUMER'S current utility bill.

This Warranty gives you specific legal rights, and you may have other rights which may vary from state to state. Any and all inquiries or claims under this Warranty must be submitted in writing to The LeverEdge, Attn: Warranty Department, 1423 Gunn Highway, Odessa, FL 33556.

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