EARTHNET ENERGY®

Where everyday's a Sun day...™

Installation and Operation Manual

Models ENE 16 and ENE 24

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INTRODUCTION

To begin, EarthNet Energy would like to thank you for choosing our Solar Thermal System for your application. EarthNet Energy is a USA solar thermal manufacturer and an alternative energy solutions company. In purchasing this product, you have helped to supply jobs to the American economy, strengthen the industrial base of the country, and reduce your carbon footprint within the environment. The installation of the ENE System will provide you with many years of excellent service and energy savings that will help you move towards energy independence.

This system is certified by the Solar Rating and Certification Corporation (SRCC-OG100) and is designed to the highest performance standards. We have prepared this manual to assist you with the installation of your new ENE Solar Thermal System. This manual includes information for the safe, efficient operation and maintenance of the system.
Before proceeding with the install of the system, it is required by the manufacturer that the installer is a trained ENE installer; one who successfully completed the manufacturer's training program in addition to being familiar with hydronics and solar thermodynamics. **All installations must conform to applicable federal, OSHA, state, and local ordinances and codes covering solar thermal products and applications.**

Upon successful installation of the system, the manual is to be presented to the end user once proper operation of the system has been fully explained. The manual may be provided as a hard copy or a formatted CD. To prevent injury or damage, follow all safety instructions presented in the manual.

Safety precautions in this manual are identified by a triangle caution symbol.

INSTALLATION REQUIREMENTS

Installers must be EarthNet Energy trained. Local codes must be followed and proper licenses must be acquired in the area in which the solar system is installed.

A. Site Assessment

Location and Collector Orientation

1. **Collector Orientation**: The collector should be installed on a south-facing roof or ground mount. Collector performance is optimized when facing true south, but can be oriented 30° east or west of true south with minimal loss in performance. The ENE System is designed for easy orientation so the tubes can be positioned for optimum efficiency.

2. **Roof Assessment**: A shade analysis should be completed prior to the installation to ensure that there are no shading obstructions. One of the shade analysis tools, referenced in the tool section, should be used to complete an accurate analysis. Additional areas of consideration would include age of the roof, structural integrity, rafter-mounting locations, pitch, attic access, and the most logical pathway to the mechanical room.

3. **Collector Tilt**: The proper angle/tilt of the collector will be determined by the radiance chart for the specific geographic region in which the collector will be installed. Trained ENE installers are supplied with a number of charts and help information in the training manual. Please refer to that resource for specific charts, graphs, and system information for proper orientation and installation. To maximize efficiency, legs can be sized to reach the optimum tilt for the area. If you are in a cold weather climate, you should consider snow levels when selecting leg lengths. Please refer to the chart in your training manual to calculate the proper leg combinations for the installation.

4. **Roof-Mounted Applications**: Before starting, reference the drawings/pictures that are included in the appendix relevant to roof mounting, rack assembly, and rack adjustability. Evaluate and establish the roof integrity. An engineer should be involved for commercial applications. (*Note*: If there is a question as to the fitness of the roof, the customer should be notified before proceeding with the installation.) Collectors should be mounted approximately 12 inches down from the peak of the roof. This helps to eliminate uplifting from excessive wind conditions. It will also help prevent ridge-cap venting and/or flashing penetrations. It is important to stay near the peak of the roof to help decrease the possibility of snow damming and to provide maximum workspace within the attic.

Determine rafter or truss locations, which will help eliminate obstructions within the exit and return lines to your exterior space. If there is no attic access below the collector, you may have to externally run the solar loop down the building and into the mechanical room.

5. **Ground-Mounted Applications**: Before starting, reference the material in the appendix relevant to ground mounting. ENE's ground-mount option adds diversity to your system's location. Using a ground mount enables you to meet the correct orientation and optimize your system's performance.
    a. Evaluate the location in which you are installing the ground mount.
    b. Evaluate the soil condition for any obstructions, such as rocks, underground wiring, underground plumbing, etc.

B. Collector-Plumbing Considerations

ENE recommends using L or M, rigid or soft copper in all installations. All runs of copper should be supported at each level or at 8 ft. minimums.

1. **System Pipe Insulation**: ENE specifically recommends and supplies Owens Corning SS2 pipe insulation. We recommend using this insulation, throughout the entire installation, on both the solar loop and the interior plumbing runs, with the exception of the dissipator loop.

2. **Sensors**: The 1000-ohm sensor wires are included with the module, but when extending sensor wire lengths, 18-2 shielded-sensor wire should be used with waterproof-butt connectors. Another option is for soldered connectors to be used to splice the wiring. Sensor wires are polar neutral.

3. **Access:** When installing solar system components, consideration should be made for easy access. The ENE solar tank should be elevated by a plastic, pre-fabricated platform to avoid any deterioration of the solar tank. If tying into an existing hot water heater or a boiler system, positioning of the solar storage tank should be in close proximity to simplify the system's plumbing.

4. **Mixing Valve:** When tying into an existing heating system or hot water heater, proper fittings, unions, and valves should be incorporated into the system's design. ***It is important to use a thermostatic mixing valve with the system on the outlet side of the existing hot water tank.*** 

5. **Surge Protection**: Install a surge protector with the controller. As a failsafe measure, it may be advisable to install a surge protector with an emergency battery backup.

PRIMARY SYSTEM COMPONENTS

A. Solar Collector Manifold

This is the main component of your system that collects energy from the sun and transfers it to a heat transfer fluid, (HTF). The ENE collectors consist of either a 16-tube collector or a 24-tube collector, depending upon the needs of the customer. Evaluating the customer's needs and usage demand will be the determining factor when sizing the system and the number of collectors needed. These collectors are installed with a southern orientation. The collectors can be roof mounted, ground mounted, or customized to meet any application. The collectors can also be installed in series to meet varieties of hot water applications and demands.

B. Solar Storage Tank

The ENE storage tank is a proven design, featuring a high efficient hydrastone liner to maximize heat retention. The maximum suggested storage temperature is 180°F. (There is a 4°F heat loss on average overnight.) The solar tank collects the heat energy that is produced by the solar manifold(s) from the transfer by the HTF circulating through a coil heat exchanger located within the tank. Our ENE hydrastone solar tank comes in two different sizes including 80 gallon and 119 gallon capacities. Both sizes come with a single coil heat exchanger and electric back-up. Our larger model is also available, with a dual coil option, for other applications such as boiler back-up heat.

C. Solar System Control Module

The module consists of several very important components and safety devices for the efficient operation and collection of data for the system. The module houses a three setting, variable speed pump, which moves Heat Transfer Fluid (HTF) through the solar loop and into the heat exchanger in the solar tank. This process transfers heat in the HTF, through conduction, to the potable hot water in the solar tank. Flow and return temperature gauges allow for system analysis of the HTF in the solar loop, between the manifold and the solar tank. Check and shut-off valves isolate the HTF in the solar loop, from the solar module, for servicing, filling and purging, as well as prevention from any unwanted thermo siphoning. The manual venting device is designed to physically vent the air in the solar loop. The adjustable flow meter, in the module, adjusts the fluid in the solar loop for optimum system performance. The solar safety station, another part of the module, consists of two main safety components, which include a pressure gauge (indicates solar system pressure), and a safety relief valve (protects system mechanisms from elevated pressures). A filling and drain valve is used to manage the HTF within the system. The ENE System is a pressurized, closed-loop system

design. The function of the solar expansion tank is to absorb the HTF volume fluctuations, while maintaining system pressure. This optimizes the solar system's performance. A programmable controller unit within the module manages and operates the entire ENE Control Module and its component parts. A digital read-out and simplistic menu graph make initiating, monitoring, and recording (on a removable SD card) the system's performance an easy way to maximize overall performance.

D. Solar System Dissipator

ENE offers a dissipator kit to protect and prevent the system from overheating. It consists of a three-way, 24-volt solenoid valve, a 24-volt transformer, and a radiant coil dissipator. When the solar storage tank reaches a pre-determined temperature, the controller diverts the HTF through a dissipation coil. The solenoid valve has the capability to divert to a second storage tank, a swimming pool application, a fan coil heater, or a radiant dissipation coil. The dissipator has up to a 15,000 BTU/HR capacity and will protect either an ENE 16 or an ENE 24 system.

INSTALLATION INSTRUCTIONS

A. Tools: A typical install will require an assortment of tools necessary to make the job easier. The list below is the complete set of tools, with the exception of hose tools, that will be required for any extraordinary circumstances.

- 7/16" wrench/socket for the bolts that hold the clamps on the bottom rail
- 9/16" socket or wrench to hold the manifold, cross members, and bottom channel together. The same size bolts are also used to hold the manifold frame to the support legs.
- Tape measure, marking pencil, chalk line, plumb bob
- Propane torch (Turbo), map gas
- Drill, drill bits, pipe bender (for soft copper), pipe cutters (short), misc. plumbing copper pipe & fittings
- 18-2 shielded sensor wire, wire strippers, waterproof/spliceable electrical wire, silver solder
- Transfer pump, force pump, electric pump, ½ h.p. fluid transfer pump (Grainger Catalogue), air compressor or hand pump
- OHM Meter, stud finder, Inclinometer, shading analysis tools (Wiley Asset, Solmetric, Solar Pathfinder) refractometer (testing the glycol solution)
- Thermostatic mixing valve, wire cloth, flux/flux brush, isolation valves
- Caulking gun, high temperature caulk, M-1 caulk
- Glycol (5 gal. USP food grade), ph test strips
- Insulation (Owens Corning), insulation cover
- Ladders, work lights, flashlight, drop cloths/fireproof sheet, duct tape, tie wraps, 2-garden or washing machine hoses for filling system bucket, fall protection gear and safety equipment (per OSHA safety requirements)

B. Pre-Installation Parts Inventory: Be certain to ensure all of the components are accounted for. Do not remove any evacuated tubes from any boxes until you are ready to install. ***Being exposed to the sun without having the proper install of the system can result in damage or injury.*** 

1. **Roof-Top Assembly:** The installer must confirm the location of the collector(s) with the homeowner, in advance to the actual install of the system.

2. **Rack Assembly**: First, assemble the system's racking. This will help to determine the spacing and positioning on the roof. (Refer to Rack Assembly Instructions.) Note: Tilt angles and leg placements, on your racking, should be pre-determined. Refer to Adjustability Chart. Leg attachments should only be hand-tightened at this point to allow for adjustability until the final placement of the collector is established.

3. **Leg Positions**: After determining the tilt angle, you will have to determine the space between the leg attachments. This will enable you to draw the lower horizontal chalk line so that the leg positions can be identified, in reference to the peak. (Reference Leg Spacing Chart.)

4. **Rafter Hooks**: In order to attach to the rafters, we suggest using our **rafter-hook attachments** (available from ENE) with our rack assembly. Make sure you fully understand how the hooks will be fastened before making any roof penetrations. ***Caution: Do not drill into the rafters to attach the collector to the roof. This will weaken the integrity of the roof.*** 

5. **Roof Penetrations**: Before making any roof penetrations, you can drill a pilot hole, using a smaller diameter drill bit, next to the rafter. Keep in mind the placement of the rafter-hook attachments in reference to the rafter locations. We suggest drilling from an interior location, out. That hole can then be used to measure the adjacent rafter locations for the proper mounting. We do not suggest mounting or drilling into any roof rafter or joist. It jeopardizes the integrity of the roof. Blocking, unistrut, and all-thread are all options when using rafter hooks to secure your system.

6. **Drilling**: After the leg hole locations are established, drill the holes, starting with the bottom two legs, then continue following the horizontal chalk line or laser, if used.

7. **Adhesives:** After the holes are drilled, shoot the **M-1 Adhesive** (available from ENE) in and around the pre-drilled hole before the all thread is inserted in the hole. Use M-1 roof sealant on the underside of the legs before positioning over the roof hook protruding up through the roof. Use a small bead of M-1 around the outside perimeter of the leg plate, after the leg is attached to the roof. After the bottom two legs are completely attached, measure up the roofline and square off before drilling the top leg holes. When the top legs are attached, continue following the same procedure as the bottom legs. (We do not suggest the use of silicone because it will break down over time.)

8. **Manifold:** It is now time to attach the manifold to the framework with the supplied hardware. It is very important to align the manifold slots in position to the bottom rail. It is suggested that you temporarily install an evacuated tube in the left and right manifold wells to assist in the location of the bottom rail attachments. Use the right and left frame rail as a reference point. Make any adjustment needed by shifting the manifold to the right or left to meet the alignment. After making sure the frame and manifold are squared and aligned, tighten the hardware on the frame, including the legs. Carefully remove the tubes and securely place them back in the box. Close the box until the final installation is completed and ready. (Caution: The condenser on the end of the tube can become extremely hot. Make certain the tube is not exposed to the sun, except for a brief amount of time. I so, allow the condenser to cool prior to placing it back into the box. (The condensers will rapidly increase in temperature with minimal exposure.)

9. **Multiple Collectors**: (When there are multiple collector scenarios, we suggest using our **Adjustable Bracket** for height adjustability and alignment.) There is adjustability in the

lateral movement of the collector's manifold and bottom rail through the utilization of the slots. When multiple collectors are used, the above steps are repeated, allowing for approximately three inches of space between the collector's manifold piping.

C. Solar Loop Roof Penetrations:

1. **Hole Sizing**: Your manifold has 1 ¼" rigid copper on both the inlet and outlet sides. You will need to reduce your solar loop to and from the manifold, in most cases, usually to a ¾" pipe. On the inlet side of the manifold you will have to solder into place a 1 ¼" 90° to the reduced piping being used. On the outlet side you will have to solder into a place a 1 ¼" x ½" x 1 ¼" T, with the ½" dimension diameter facing upward. Next, you will solder a reducer bushing onto the top of the T (1/2" slip x 1/8" female). A 1/8" coin vent will be screwed into the fitting. When this is completed, you will have the air vent for the manifold. A 1 ¼" x appropriate sized bushing will be soldered into bottom of the T. Use a plumb bob to determine the location of your holes and to where the inlet and outlet lines from the manifold will be ran.

   Note: Calculate your minimum hole size, using your piping diameter, with the fire sleeve attached. Check with the local building codes for any additional clearances needed. We suggest using a 1/8" drill bit pilot hole to ensure the final hole placement is at the appropriate location. ***(Caution: Double check to ensure there are no obstructions where you will be drilling.)*** 

   Due to possible high temperatures, it is very important to use fire sleeve when passing through or near combustible materials. 

   Note: Make sure you are using L or M copper and silver solder.

   Note: We highly recommend using our high temperature roof boots for installation. Keep in mind, the temperatures coming from the outlet side of the manifold can exceed 400°. Be sure to install the roof boots according to the specific roof specifications. Our roof boots work well with asphalt and metal roof applications. For tile or rubber membrane roof, consult with the original installer or a roofing professional for the correct flashing and installation procedures. Use our M-1 adhesive and sealant with the installation of the high temperature roof boot.

   Note: When using our high temperature roof boot, you will have to carefully cut a ¾" hole in the roof boot and slide it over the copper. When in place, use M-1 mastic to seal it to the roof, and use our high temperature sealant at the top of the roof boot where the copper protrudes.

   Note: Before applying the high temperature sealant to the top of the boot, run your high temperature sensor wire (the orange colored wire provided in the module kit) from the manifold through the roof boot, coming from the discharge side of the manifold.

Route the wire through the roof boot and adjacent to the piping. This step should be carried out after pressure testing the system and prior to insulating the lines.

Note: The high temperature sensor wire is 5' long. If the manifold stands 5' off the roof, the sensor wire may need to be spliced, using butt-connectors, prior to penetrating through the roof. Measuring from the outlet side of the manifold, following the piping, determine the length of the run into your interior space. This is approximately how much wire you will need for the install, after the system has been commissioned and before insulating the solar loop. The remaining wire will be installed, through the roof boot, adjacent to the piping. Use the high temperature sealant to seal the roof boot and the sensor wire before it is insulated. The sensor wire should then follow the solar loop and be connected to the solar module. The high temperature wire will be attached at the collector's outlet side, with the sensor probe being right underneath the fire sleeve.

Note: The placement of the sensor probe should be at the 3, 6, or 9 o'clock position under the fire sleeve.

D. Storage Tank Installation: We suggest running rigid copper from the manifold to at least 18 inches below the roofline. From this point, soft copper can be used, depending upon your pathway to the mechanical room. Use fire sleeve whenever you are passing through combustible material and be sure to allow enough space to insulate the solar loop lines.

Note: It might be a good idea to mark your solar loop lines so you can distinguish the inlet and outlet lines of the loop.

Note: Reference your local building codes for fire-stop installation requirements.

1. **Mechanical Room Assessment**: You will have to evaluate the mechanical room and determine if you are going to tie into an existing hot water heater or any other hydronic heat source appliance.

2. **Tank Location**: Locate the solar storage tank next to the existing water heater, if applicable. Place the tank on a raised platform.

3. **Heat Exchanger**: Install the heat exchanger in the solar tank.

E. Module placement: Mount the module on the wall by following the specific instructions in the appendix and locate it near the solar tank, if possible.

Note: Keep in mind you will need a 110v receptacle power source for your solar module. We suggest using a surge protector.

1. **Module Plumbing**: Plumb from the module to the tank. Install the unions in a line, before the heat exchanger, so there is easy removal for cleaning and maintenance. If a dissipator is being installed, install the plumbing fittings and components at this stage.

   Note: ***When silver soldering the solenoid valve, it is necessary to disassemble the valve before soldering.*** 

   Note: To fully drain the solar loop, a drain valve is recommended at the lowest point in the loop. Alternatively, use the solar module to drain the entire system with an air pump. ***Do not turn on the module until the system has been filled with fluid.*** 

2. **Grounding**: Ensure proper earth grounding via the plumbing circuit or an additional ground cable. Ground the system, using a grounding clamp, on both the supply and return lines. Make sure the grounding is connected to the building grounding strip by the means of a standard PVC-sheathed bonding cable.

3. **Attaching Safety Assembly**: Install the safety assembly onto the solar pump station using the gaskets supplied (Gasket hanging from the safety assembly). The safety assembly has a pressure relief valve, a pressure gauge, and an attachment for the expansion tank.

4. **Sensor Wire**: Connect the sensor wire (T1) running from the collector to the solar module and connect it to the controller. Use the wiring graph instructions, provided in the appendix, on the last page of the module manual. (T2) sensor wire (gray) is placed just above the solar tank heat exchanger, behind the mounting bracket. A second optional location could be the thermo well, located at the bottom right-side of the tank. If using this well, insulate behind the sensor so the ambient temperatures do not affect the sensor-reading outputs. Note: The module has the capability of using three other sensors. (T3, T4, T5).

5. **Expansion Tank**: Install the expansion tank. The expansion tank should be installed on the module safety station using rigid copper. (Be sure to use the washers supplied with the safety station to connect the safety station to the module body.) If support is required, use a support bracket.

   Note: Refer to the appendix for sizing and calculations of the expansion tank. ***Expansion tank pressures should be calculated to the solar system loop pressure.*** 

   Note: The ENE expansion tank on the solar loop protects the solar loop system. An additional expansion tank may be needed on the potable water side of system. Check with your local plumbing codes.

6. **Pressure Relief Valve**: The pressure relief valve in the safety station is 87 psi. Local codes will determine final termination of the line.

F. Final System Initiation Preparation

1. **Flushing the System**: See Appendix for flushing and charging recommendations and instructions. Flush the solar loop with potable water to clean and remove any foreign material in the system.

2. **Valve**: Attach a garden hose from the household supply to the bottom of the hose bib and open the bottom valve. GHT drain at the bottom of the safety fitting.

3. **Fill and Flush**: Turn the gravity brake ball valve (blue) to a 45° angle. Open the fill and flush and drain valve.

4. **Hose**: Attach a garden hose to the bottom valve, open the bottom hose bib, fill flush, and drain valve.

5. **Flush**: The system should be flushed to remove any debris, prior to charging with the high temperature fluid propylene glycol. (Any impurities can affect the ph of the glycol.)

   Note: The parts are identified in the Module Appendix.
   Attach the garden hose to the safety attachment fill, flush and drain valve and flush with water for about five minutes.

6. **Test**: When the system has been cleaned, close the bottom drain valve and pressurize the system to at least 50 psi, in order to check for leaks. Check local codes to determine the time required for system assessment. (Example: Some codes may require air testing over a period of 24 hours.)

7. **Drain:** After the system has been flushed, it is critical to completely drain the entire solar system loop.

8. **Insulation**: After the system has been checked for leaks, it is now time to insulate all of the plumbing lines. ***(Owens Corning SS2 high temp insulation. Do not use any lower temperature, pre-fabricated line sets with the ENE System.)*** Before installing the PVC wrapping, install the sensor line parallel with the insulated lines. Inspect the plumbing for sufficient support.

9. **System Charge:** Charge the system with propylene glycol (HTF), using a sufficiently sized pump that is capable of producing the proper pressure. Pressurize the system to the required pressure based upon the system design. The system pressure should be at least 30 psi. The system should be ran for a minimum of 15 minutes with the air purging intermittently between the collector air bleeder vent and the module air bleeder vent. (Make sure the air is completely purged from the solar loop or the performance can be

jeopardized.) We suggest returning to the installation after two days of operation to bleed any additional air from the system and to complete a system check.

Note: After charging the solar loop, the right ball valve should be turned to the 12:00 o'clock position before for the system is turned on.

10. **Plug In**: Plug in the module and refer to the appendix section and module programming to establish operating parameters.

11. **Evacuated Tube Installation:** It is now time to install the evacuated tubes in the system**.** One at a time, carefully remove the evacuated tubes from their packaging, making sure to not leave any open boxes with tubes exposed to the sun. ***Temperatures at the condenser can reach up to 477°.*** 

MAINTAINING THE ENE SOLAR THERMAL EVACUATED TUBE SYSTEM

1. **Frequency:** An annual maintenance and assessment program should be established with the ENE dealer/installer to keep the system operating smoothly. Active solar systems do not ordinarily require much maintenance but some measures can be taken to add years of cost savings to your system.

   Additional measures, as listed below, can also be helpful:

2. **Collector Shading:** Check to see if any additional shading factors have arisen over time that could diminish the efficiency of the system. Check at various times of the day (mid-morning, noon, and mid-afternoon). Shading can greatly affect the performance of the solar collectors. Vegetation growth over time, or new construction on your house, or your neighbor's property can all possibly produce shading that was not there when the collectors were originally installed.

3. **Collector Soiling:** Dusty or soiled collectors will perform poorly. However, the evacuated tube is not as easily affected by normal levels of dust. Rainwater should provide a natural rinse in most situations. However, if the collector is in an area where higher levels of materials collect, additional cleaning could be needed.

4. **Plumbing, Ductwork, and Wiring Connections**: Check for fluid leaks at all pipe connections. Check duct connections and seals if using a dissipator or space heater. All wiring connections should be tight.

5. **Piping, Duct, and Wiring Insulation:** Check for damage or degradation of insulation covering pipes, ducts, and wiring.

6. **Roof Penetrations:** Flashing and sealant around the roof penetrations should be in good condition.

7. **Support Structures:** Check all of the nuts and bolts attached to the collectors and to any other support structures for tightness.

8. **Pressure Relief Valve:** The relief valve should be checked for proper operation. Lift the pressure relieve lever several times to make sure it moves freely and returns to the closed position.

9. **Pumps or Blowers:** Make certain the pumps are functioning properly. If your system includes a dissipator, make sure any fans or blowers have been oiled, if necessary.

10. **Heat Transfer Fluids:** The glycol/water antifreeze solutions need to be replaced periodically. When using propylene glycol, you should check it every year for its effectiveness and pH. The ideal pH is 7.2 to 7.6. As soon as the pH reaches a minimum

of 5 or a maximum of 9 it should be replaced. Cleaning the internal heat exchanger may also need to be accomplished at the same time the glycol is changed. If there is a hard or soft water problem and the pH is not maintained, the exchanger may need to be cleaned more frequently. Again, an authorized ENE dealer/installer must accomplish the draining and the recharging of the system. A soft bristle brush can be used on the exchanger to eliminate any scale from the fins.

11. **Solar Storage Systems**: Check storage tanks, fittings, and pressure relief valves for cracks, leaks, rust, or any other signs of corrosion.

TROUBLESHOOTING

As a standard operating procedure, always check the controller for correct settings FIRST.

PROBLEM	RESULT	CAUSE	SOLUTION
No flow on flow meter despite pump running	No solar temperature	Air in the system	Bleed air at air vents
		Valves are closed	Open shut off valves
		Dirty flow meter	Clean flow meter
Noisy solar loop at high temperatures (vapor knocking)	Leakages in the solar system	Air in system	Bleed air at vents and/or purge system
		Expansion tank too small and/or faulty	Make sure expansion tank is sized properly and charged to correct psi system design
		Pump speed too low	Turn to high pump speed and make sure impeller turns freely and is free of dirt
		Braking valves not fully open	Fully open all valves
System performance is dropping	Solar tank temps low	Air in system	Bleed air vents
		Incorrect pump speed	Check pump speed with flow meter
		Shaded collectors	Remove obstacles
		Dirty collectors	Clean tubes
		Dirty solar tank heat exchanger	Flush and clean heat exchanger

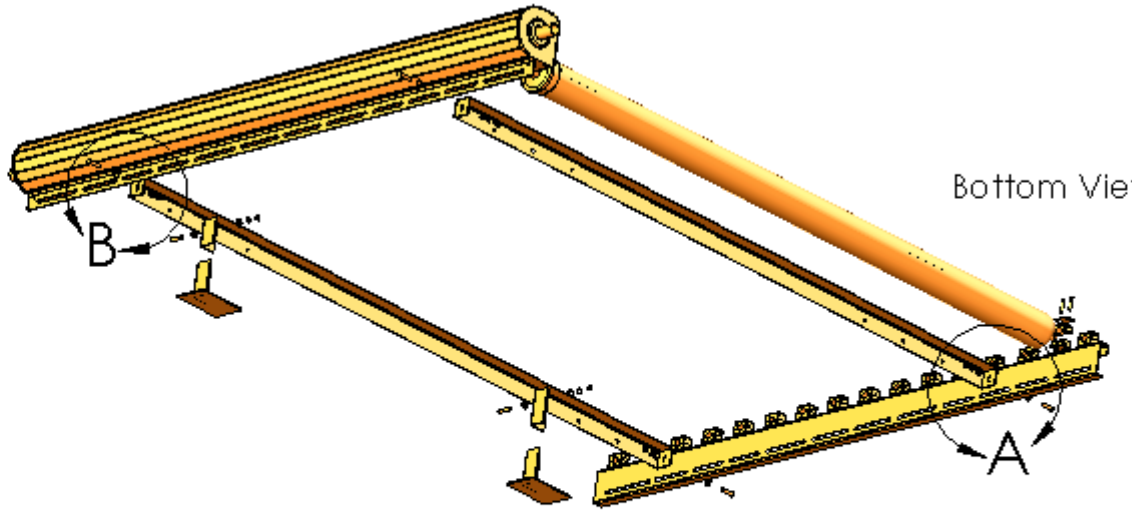
PROBLEM	RESULT	CAUSE	SOLUTION
Pressure drop in solar loop, not heating	Solar loop went into stagnation	Incorrect controller correct settings Sensors faulty or out of place Solar storage tank temp set too low	Reprogram controller Reinstall sensor wires or replace Increase solar tank temp setting
No heat in solar tank	Solar loop pressure drop	Leak in solar loop Expansion tank leaking Air vent leaking	Repair leak in piping Reset expansion tank and charge to correct pressure Tighten and/or shut air vent
Domestic hot water too hot or too cold	Risk of scalding and/or not hot enough	Mixing valve setting too high or low or is faulty Solar tank set too high and/or low	Reset mixing valve temps. Make sure valve has been installed in correct location Reset tank sensor setting on controller
Pump does not shut off	Solar tank temp is dropping and running at night	Temp sensor is faulty or out of position Check settings on controller. May be set on re-cooling setting	Readjust sensor or replace Reset controller settings

PROBLEM	RESULT	CAUSE	SOLUTION
Pump kicks on and off	Low temp in solar loop and tank	Controller setting not correct Volumetric flow rate set too high Sensor out-of-place or faulty Delta T settings too close	Reset controller Check and readjust flow rate Readjust sensor or replace Readjust controller settings
Pump is not running	Solar loop over-heating and solar tank cooling	Pump is bad Pump is humming but not running Pump not responding to controller	Replace pump Clean impeller Check the controller settings and manual

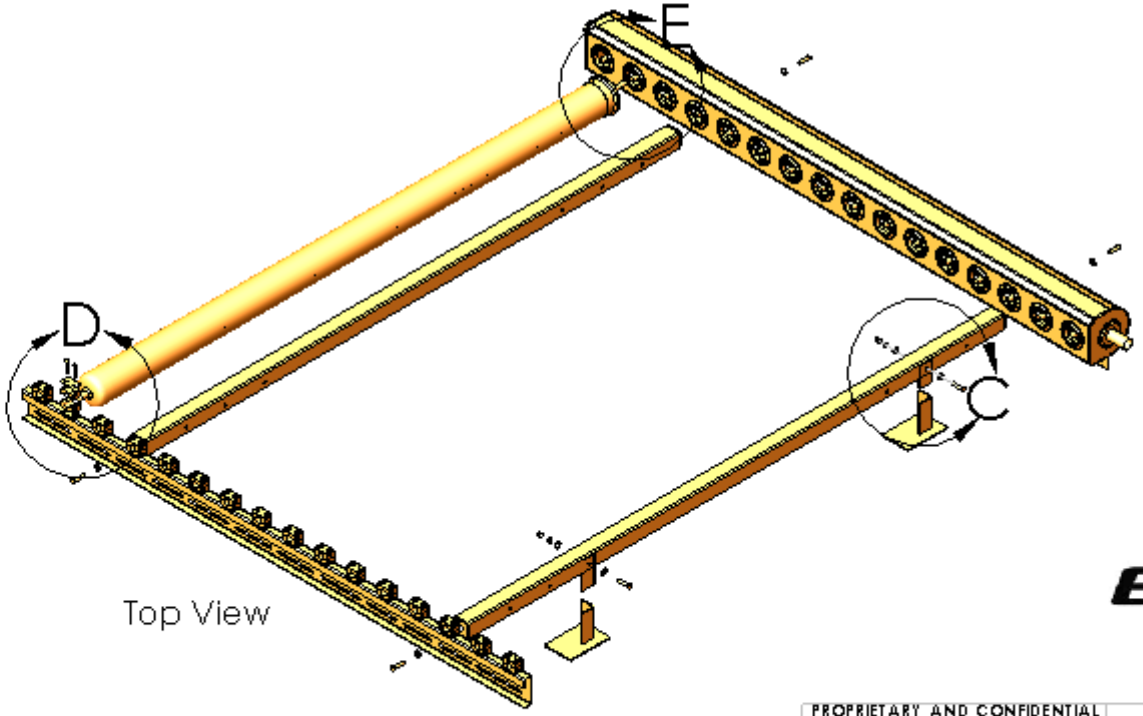
APPENDICES

Appendix I

ENE 16 Assembly



Bottom View



Top View

EarthNet Energy™

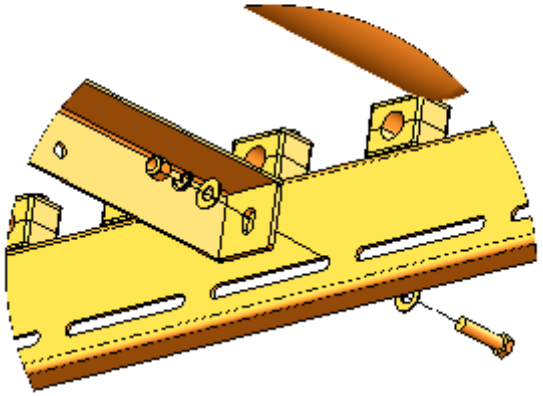
TITLE:
ENE 16 Assembly

SCALE: **1:20** | DRAWN: **TBM** | SHEET: **1 OF 3**

20

5 4 3 2 1

DETAIL A
SCALE 1 : 5



EARTHNET ENERGY®

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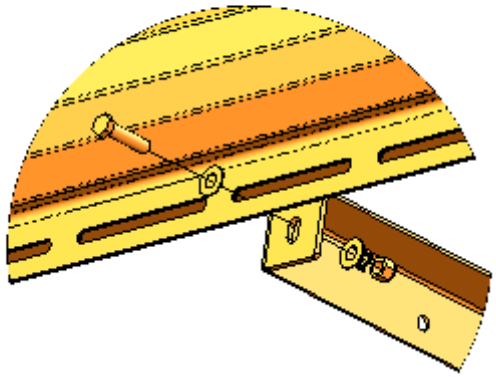

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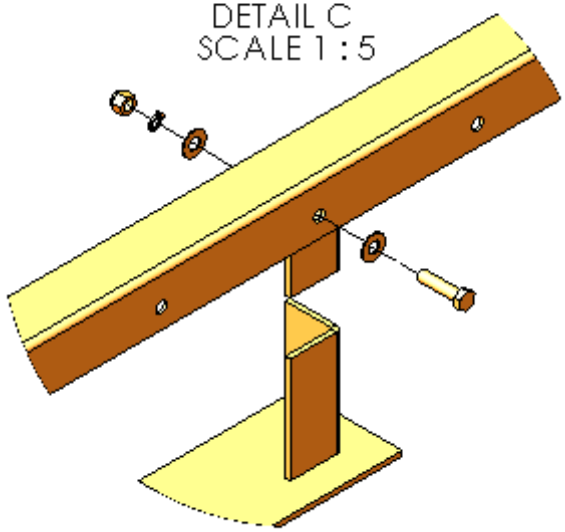
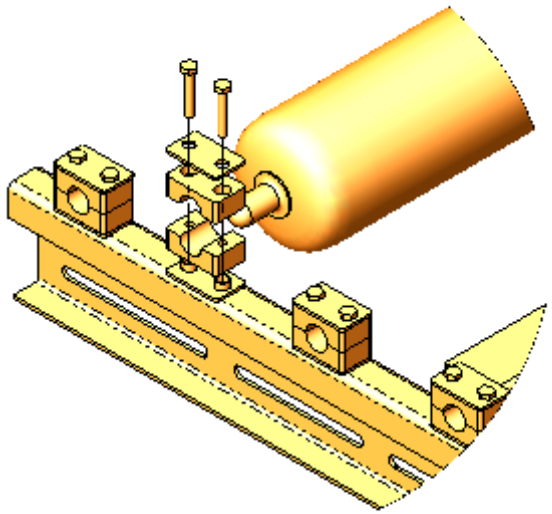
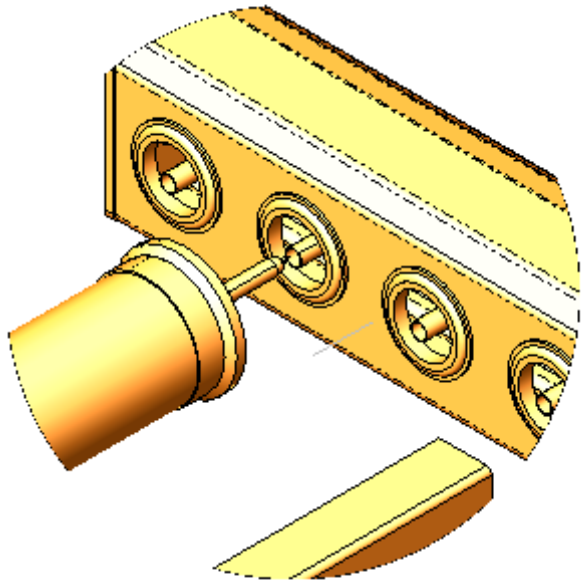
SCALE 1 : 5





DETAIL D
SCALE 1 : 5



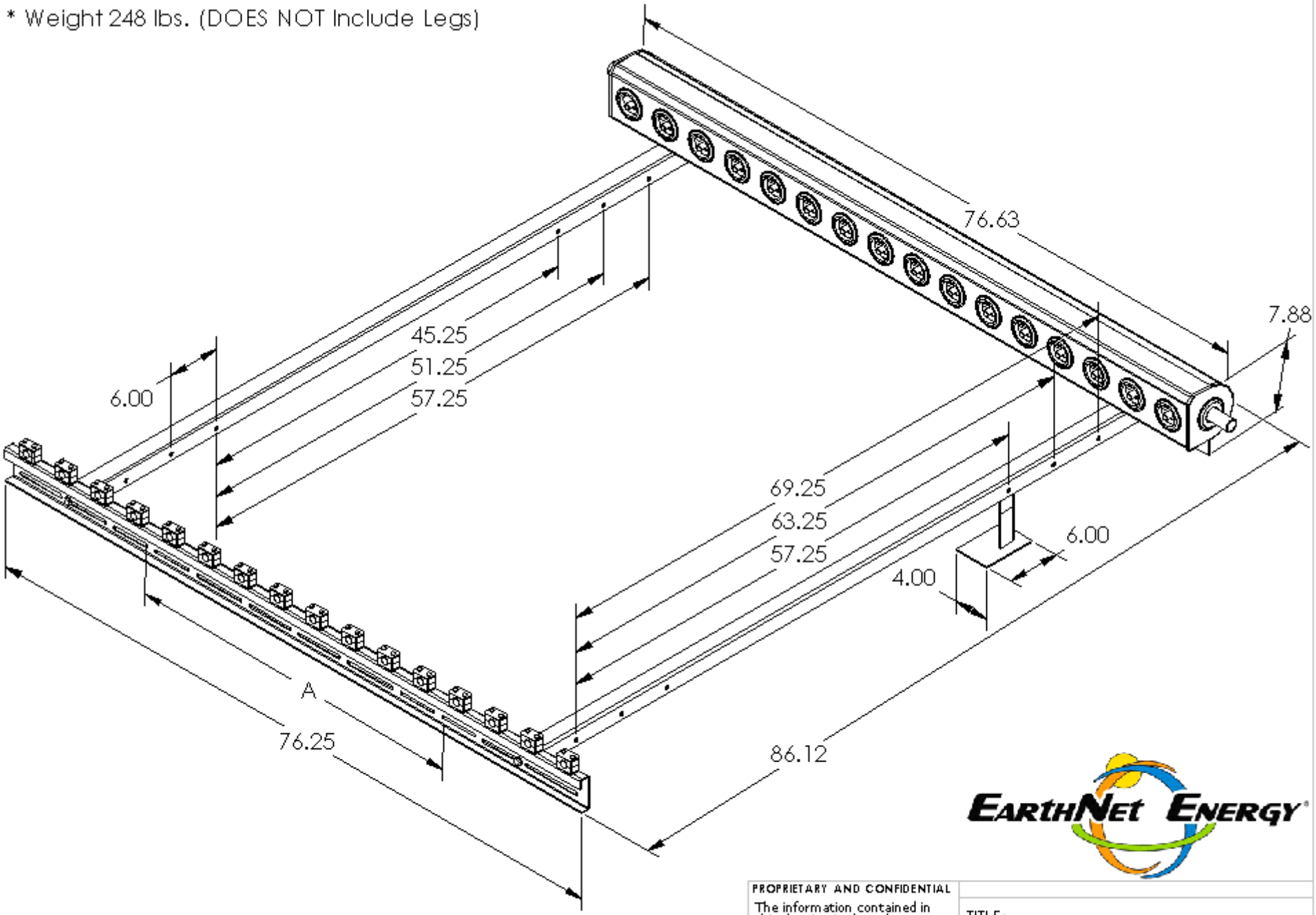
DETAIL E
SCALE 1 : 5

SHEET: **2 OF 3**

21

5 4 3 2 1

* Weight 248 lbs. (DOES NOT Include Legs)



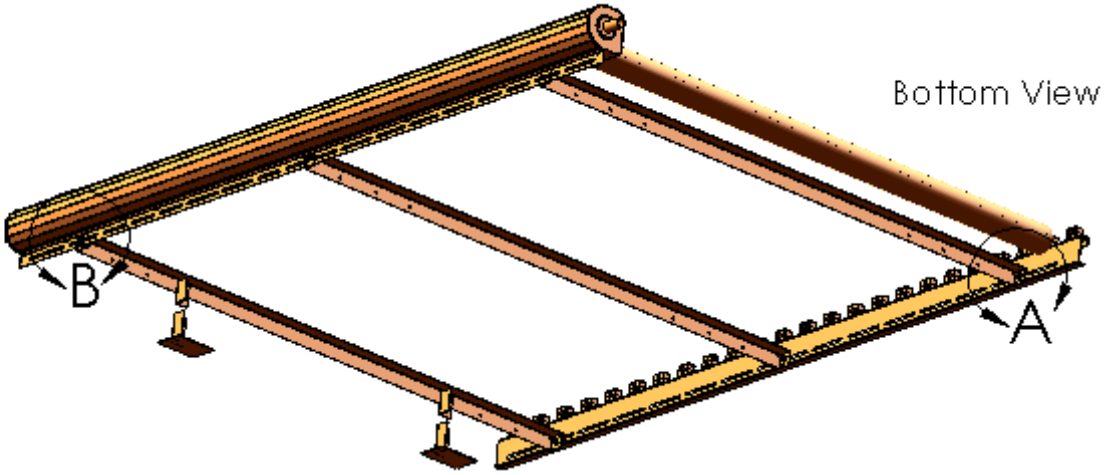
(A) Adjustable frame rail from 46.25" to 73.25" with the smallest distance shown

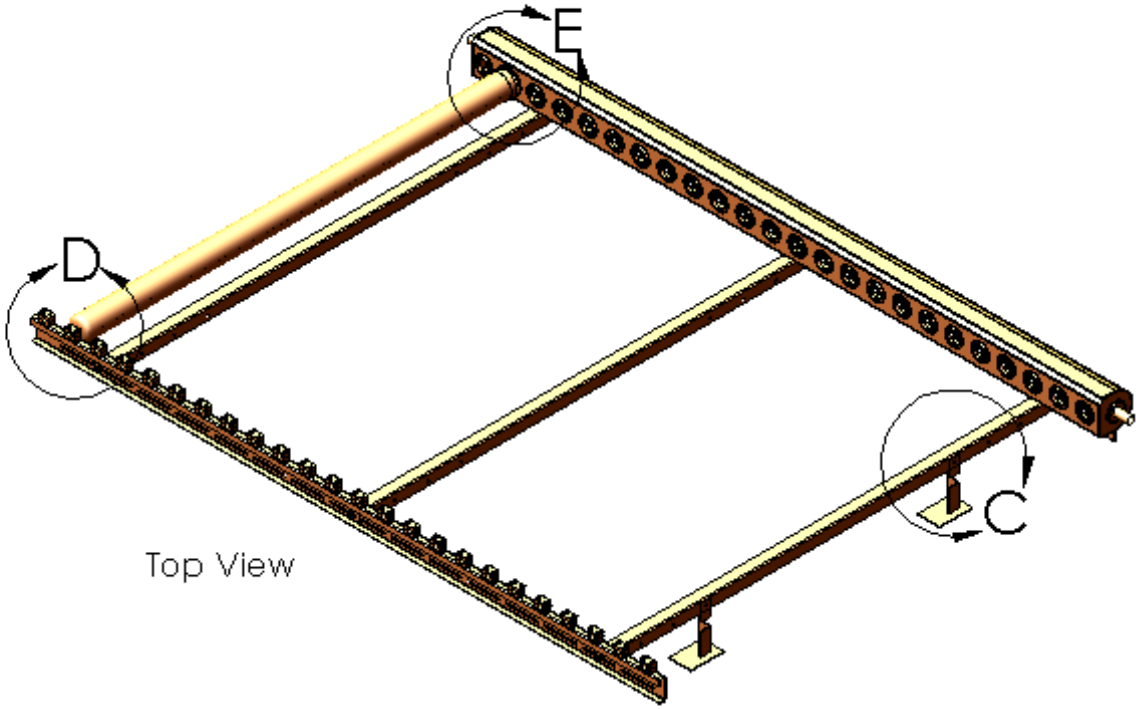
TITLE:
ENE 16 Dimensions

SCALE: **1:12** DRAWN: **TBM** SHEET: **3 OF 3**

Appendix II

ENE 24 Assembly





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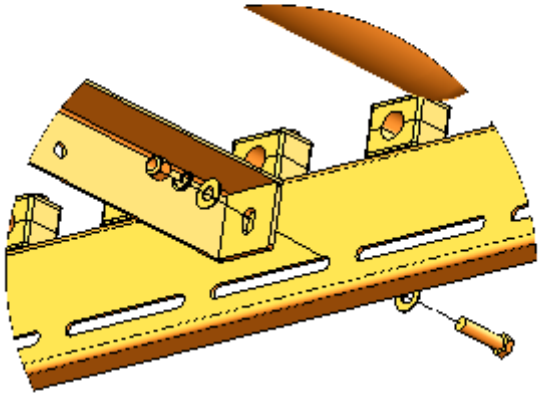
TITLE:
ENE 24 Assembly

SCALE: **1:24** | DRAWN: **TBM** | SHEET: **1 OF 3**

24

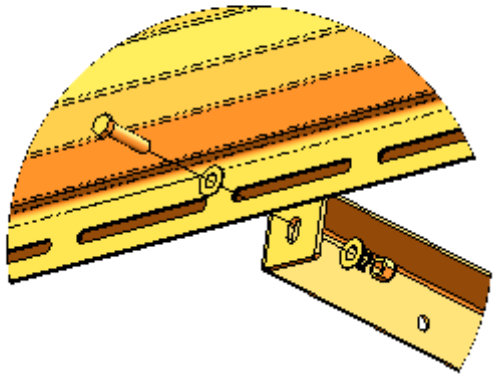
5 4 3 2 1

DETAIL A
SCALE 1 : 5

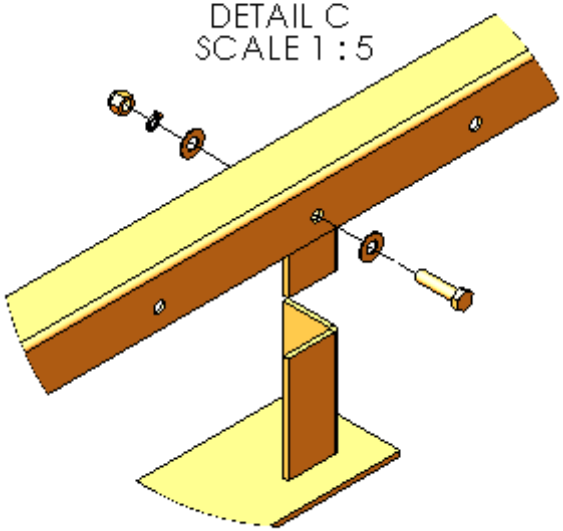


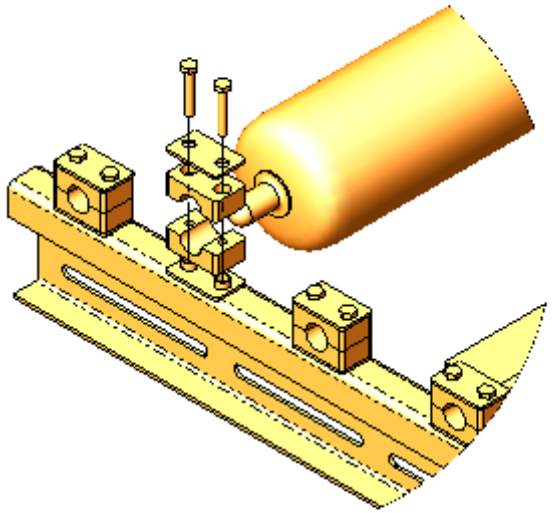
EARTHNET ENERGY®

DETAIL B
SCALE 1 : 5

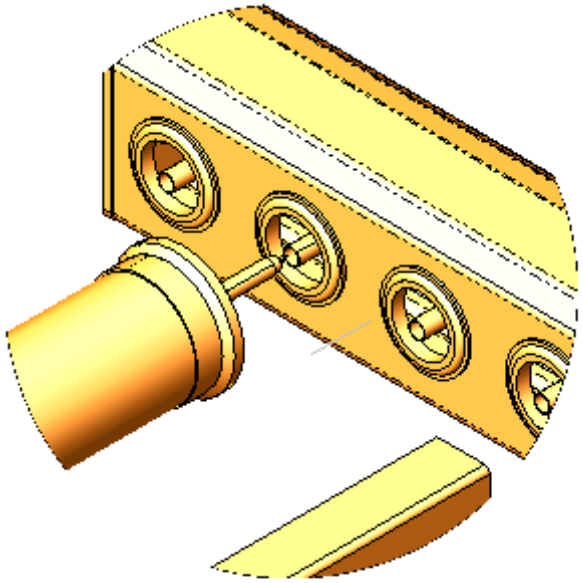


DETAIL C
SCALE 1 : 5





DETAIL D
SCALE 1 : 5



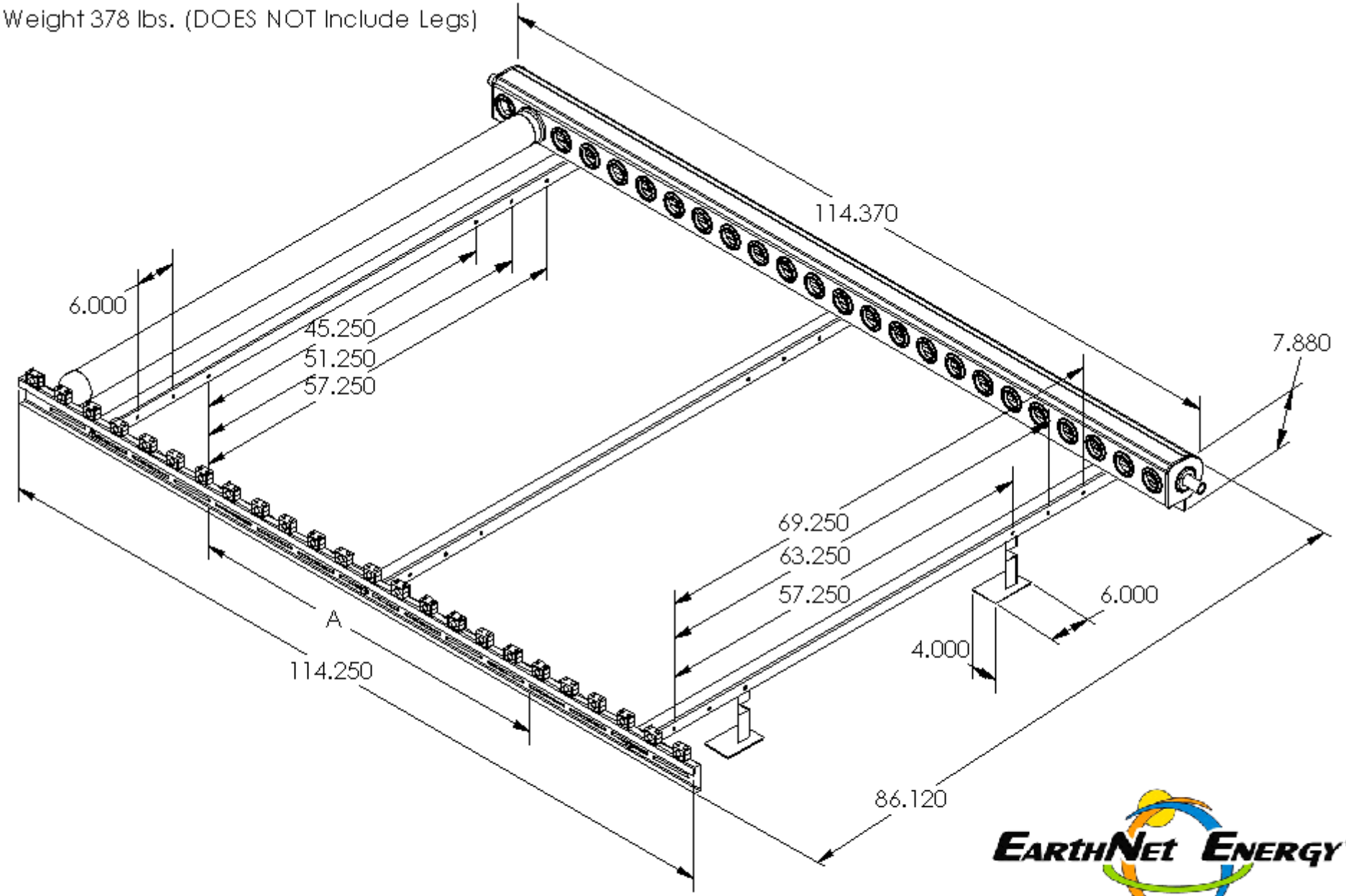
DETAIL E
SCALE 1 : 5

SHEET: **2 OF 3**

25

5 4 3 2 1

*Weight 378 lbs. (DOES NOT Include Legs)



(A) Adjustable frame rail from 66.25" to 111.25" with the smallest distance shown

TITLE: **ENE 24 Dimensions**

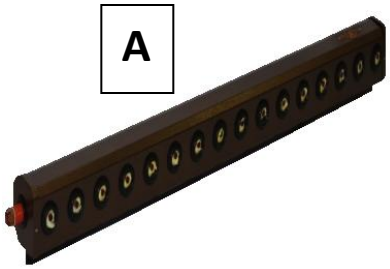
SCALE: **1:16** | DRAWN: **TBM** | SHEET: **3 OF 3**

Appendix III

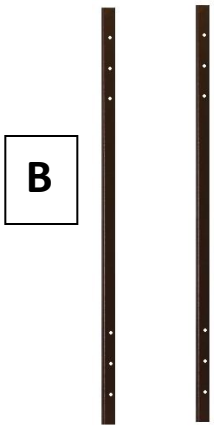
ENE 16 & ENE 24 Assembly Graphics

ASSEMBLY INSTRUCTIONS FOR ENE 16 AND ENE 24 COLLECTORS

Find Manifold **A**



Find frame rails **B**

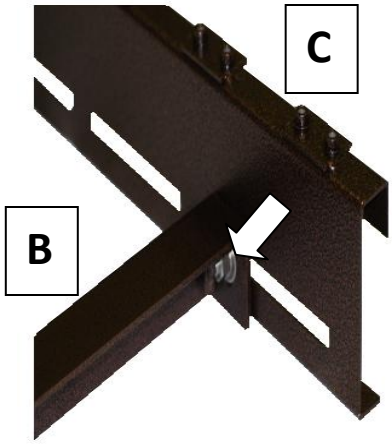


NOTE: ENE 24 HAS 3 FRAME RAILS B

Find bottom channel **C**

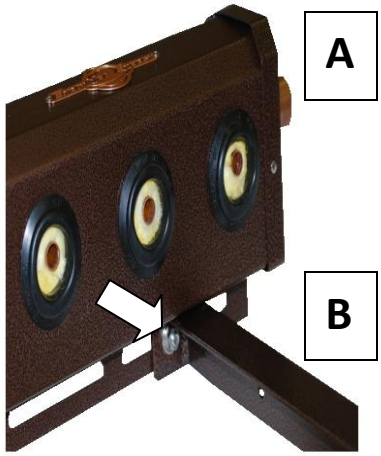
①

Attach frame rails **B** to bottom channel **C** using one 3/8" x 1" SS bolt, two 3/8" SS washers, one split lock washer and one hex nut. Repeat on both sides. Attach according to roof structure spacing requirements.



②

Attach frame rails **B** to manifold **A** using one 3/8" x 1" SS bolt with two 3/8" SS washers, one split lock washer and one hex nut. Repeat on both sides.

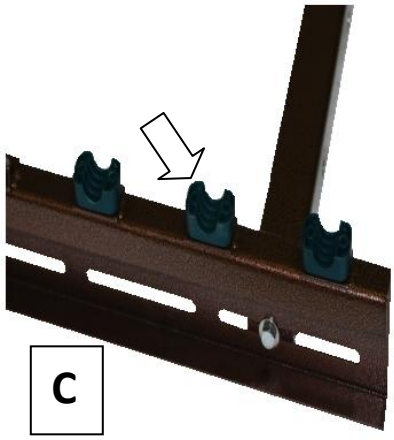


③

Attach legs as needed to achieve desired slope and angle of inclination using same hardware combination as in step 2.

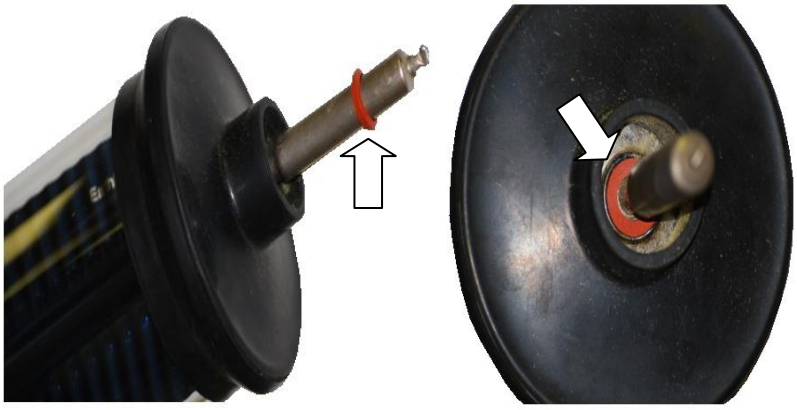
④

Install bottom portion of tube retainer and snap into place on bottom channel **C**.



⑤

After leg attachments and installation of collector is in place with all piping complete and system operating, install high temperature washer over the tube condenser and slide into place.



⑥

Layer each tube condenser prior to inserting in manifold **A** with a thin layer of high temperature thermal grease. Insert evacuated tubes in ports using a right/left rotating motion.

⑦

Attach top part of tube retainer and metal plate with two 1/4" x 1 1/2" SS bolts using a 7/16 socket or nut driver. (Caution: do not over tighten. Make sure tubes can rotate slightly)

ENE 16 & 24 HARDWARE

MANIFOLD BOX	*ENE 16*	*ENE 24*
DESCRIPTION	**QTY**	**QTY**
MANIFOLD	1	1
FRAME RAIL	2	3
BOTTOM CHANNEL	1	1
HARDWARE BAG	1	1

ENE 16 & ENE 24 CROSS BRACE HARDWARE	
DESCRIPTION	**QTY**
LEFT CROSS BRACE	1
RIGHT CROSS BRACE	1
3/8” x 1” SS BOLT	4
3/8” SS HEX NUT	4
3/8” SS SPLIT/LOCK WASHER	4
3/8” SS FLAT WASHER	8

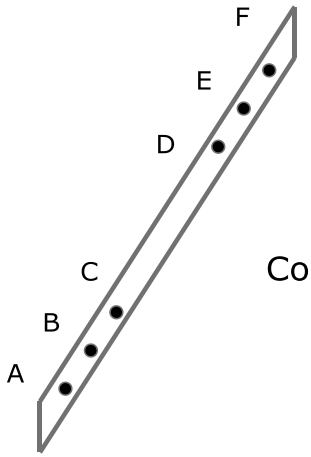
HARDWARE	*ENE 16*	*ENE 24*
DESCRIPTION	**QTY**	**QTY**
RED HIGH TEMP WASHERS	16	24
3/8” x 1” SS BOLT	8	10
3/8” SS HEX NUT	8	10
3/8” SS SPLIT/LOCK WASHER	8	10
3/8” SS FLAT WASHER	16	20
1/4” X 1 ½” SS BOLT	32	48
TUBE RETAINER	32	48
METAL PLATE	16	24
INSTRUCTIONS	1	1

Appendix IV

ENE 16 & ENE 24 Rack System Adjustability

ENE 16 and ENE 24 RACK SYSTEM ADJUSTABILITY

*Based on installation on a flat roof. If a sloped roof exists, add the degree of slope to the roof pitch and degrees as shown below.



Collector Frame Rail

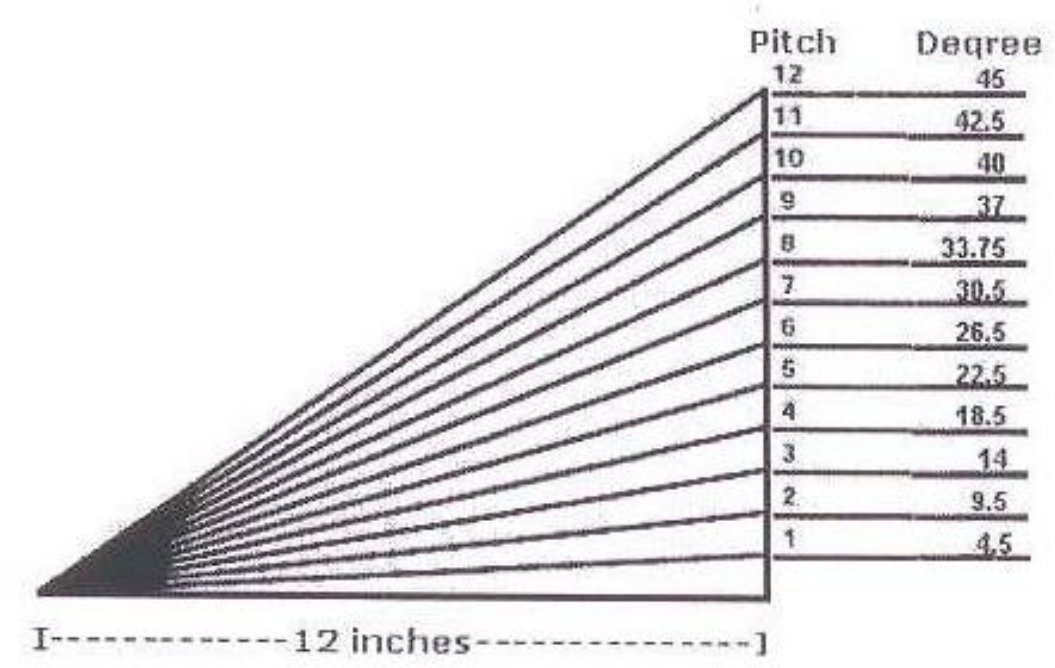
Leg Position	Leg Size	Leg Position	Leg Size	Degree of Slope
A	6"	D	1' 2'	6° 19°
		E	1' 2'	6° 18°
		F	1' 2' 4'	5° 16° 38°
	1'	D	2' 4'	12° 40°
		E	2' 4' 6'	11° 35° 72°
		F	2' 4' 6'	10° 32° 64°
	2'	D	4' 6'	25° 58°
		E	4' 6'	23° 50°
		F	4' 6'	21° 45°
	4'	D	6'	25°
		E	6'	23°
		F	6'	21°
B	1'	D	2' 4'	14° 45°
		E	2' 4'	12° 40°
		F	2' 4'	11° 35°
	2'	D	4' 6'	28° 70°
		E	4' 6'	25° 58°
		F	4' 6'	23° 50°

Leg Position	Leg Size	Leg Position	Leg Size	Degree of Slope
B	4'	D	6'	28°
		E	6'	25°
		F	6'	23°
C	1'	D	2'	16°
		E	2'	13°
		F	2'	12°
	2'	D	4'	32°
		E	4' 6'	28° 70°
		F	4' 6'	25° 58°
	4'	D	6'	32°
		E	6'	28°
		F	6'	25°

Note: 1' and 2' extensions can change slope if desired. Also, the adjustable attachment will fine-tune the slope as needed.

Roof Pitch to Degrees Equivalents

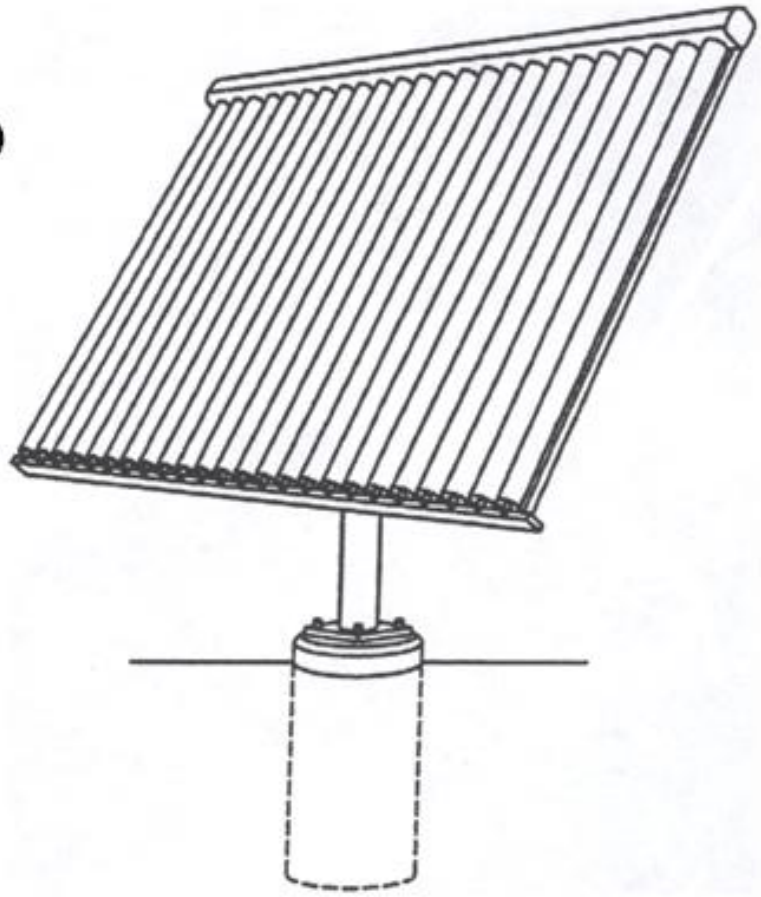
This drawing demonstrates how many degrees rise for each pitch of a typical roof. Look at the column labeled pitch, then look under degrees to get the corresponding amount of degrees. Example; 8/12 pitch = 33.75 degrees.



Appendix V

Foundation Options for ENE 16 & ENE 24 Evacuated Tube Collectors

FOUNDATION OPTIONS FOR ENE 16 & ENE 24 EVACUATED TUBE COLLECTORS



COMMONWEALTH OF PENNSYLVANIA
REGISTERED PROFESSIONAL
ROBERT H. PLANK
ENGINEER
NP021876-E

7-15-09

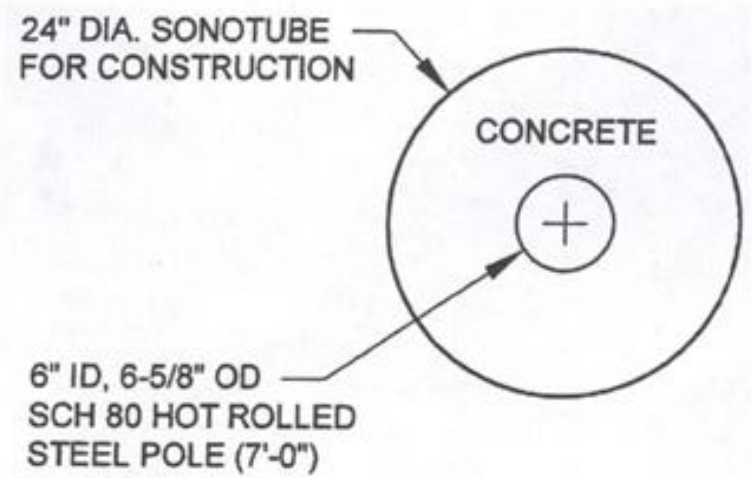
Sheets 1 THRU 6

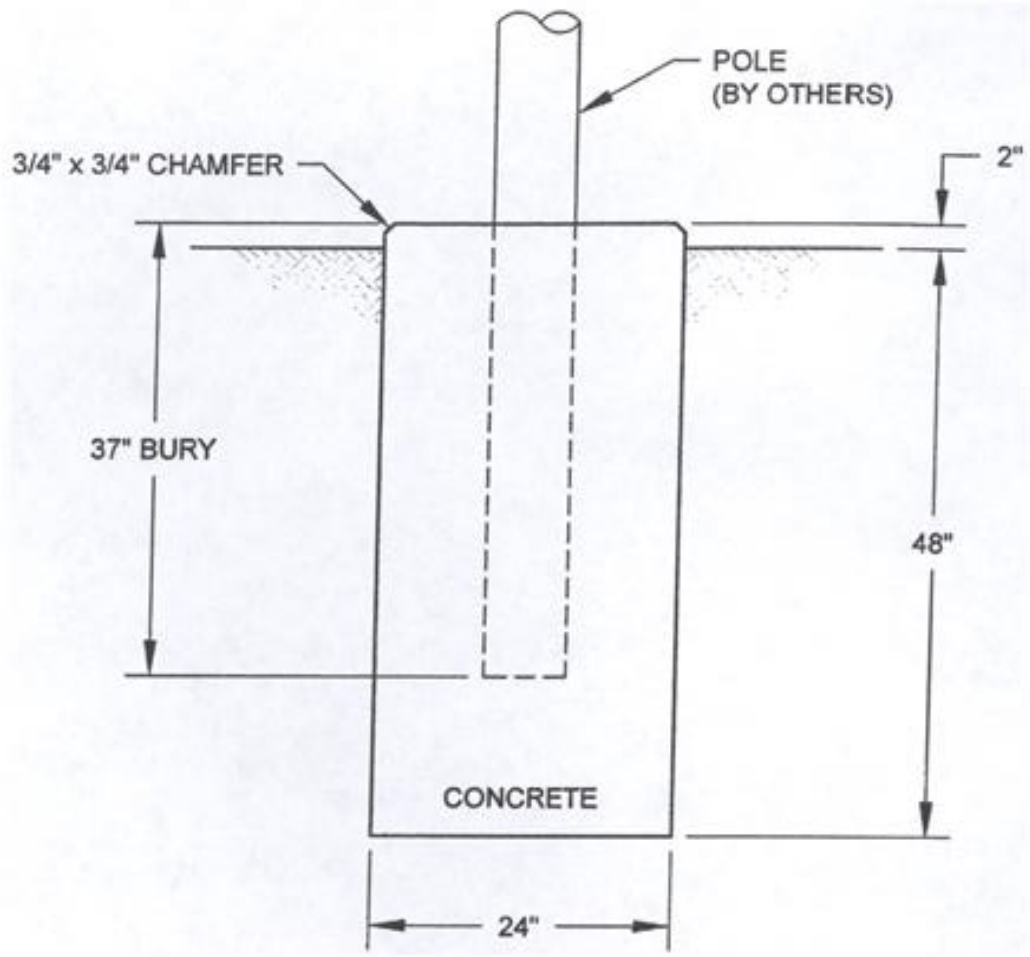
PROFESSIONAL INSPECTION TESTING SERVICES INC.
CORPORATE OFFICE
56 N. SECOND ST. • CHAMBERSBURG, PA 17201
PHONE: (717)263-7964 • FAX: (717)263-7734

EARTHNET ENERGY

Title: FOUNDATION OPTIONS FOR ENE 16 & ENE 24 EVACUATED TUBE COLLECTORS

Scale: NTS	Drawn: TBM	Sheet: 1 OF 5





PLAN

PROFILE

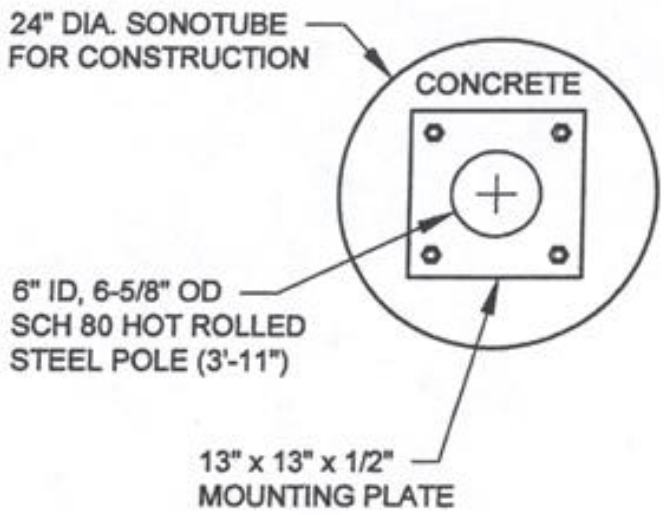
PROFESSIONAL INSPECTION & TESTING SERVICES INC.
CORPORATE OFFICE
56 N. SECOND ST. • CHAMBERSBURG, PA 17201
PHONE: (717)263-7964 • FAX: (717)263-7734

EARTHNET ENERGY

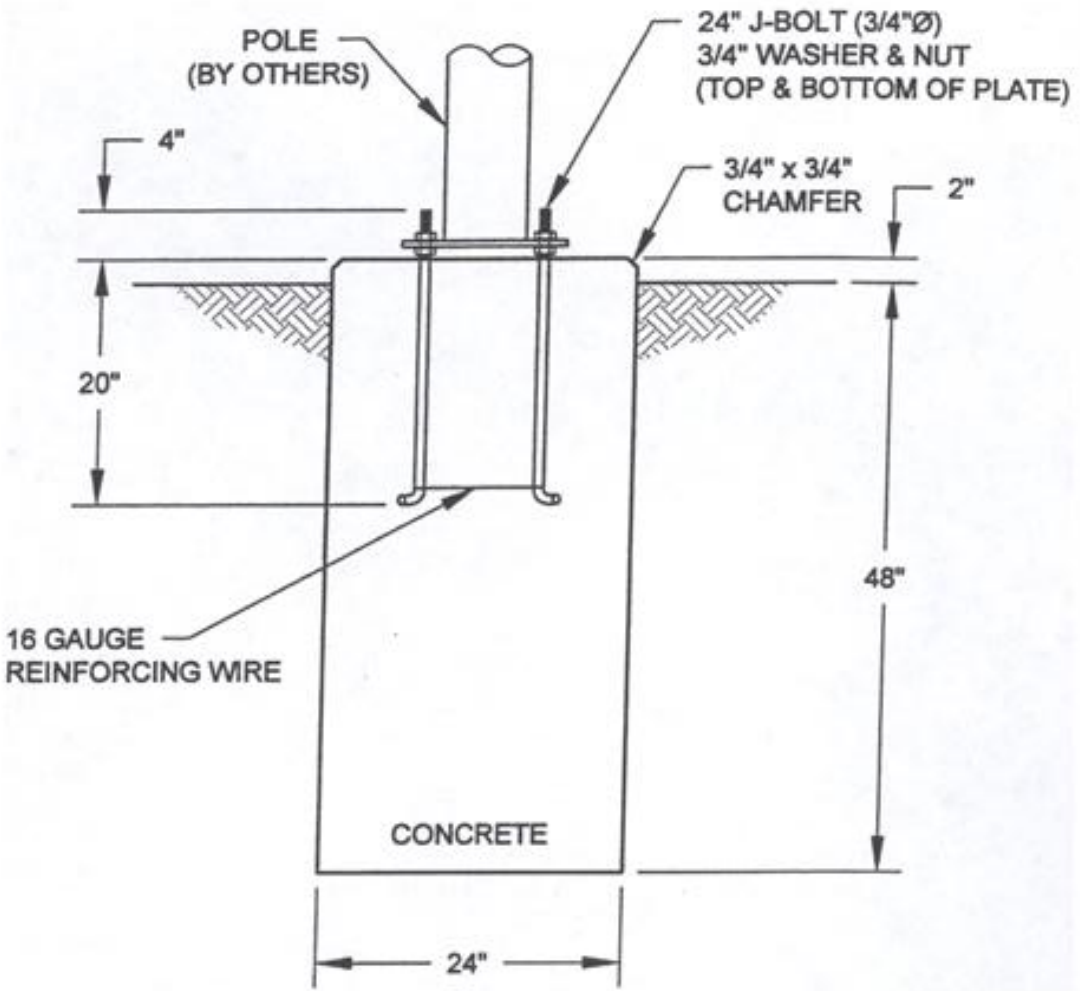
Title:

ENE EXTENDED PIPE BURIAL FOUNDATION DETAIL

Scale: 3/4"=1'-0" | Drawn: **TBM** | Sheet: **2 OF 5**



PLAN



PROFILE

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CORPORATE OFFICE
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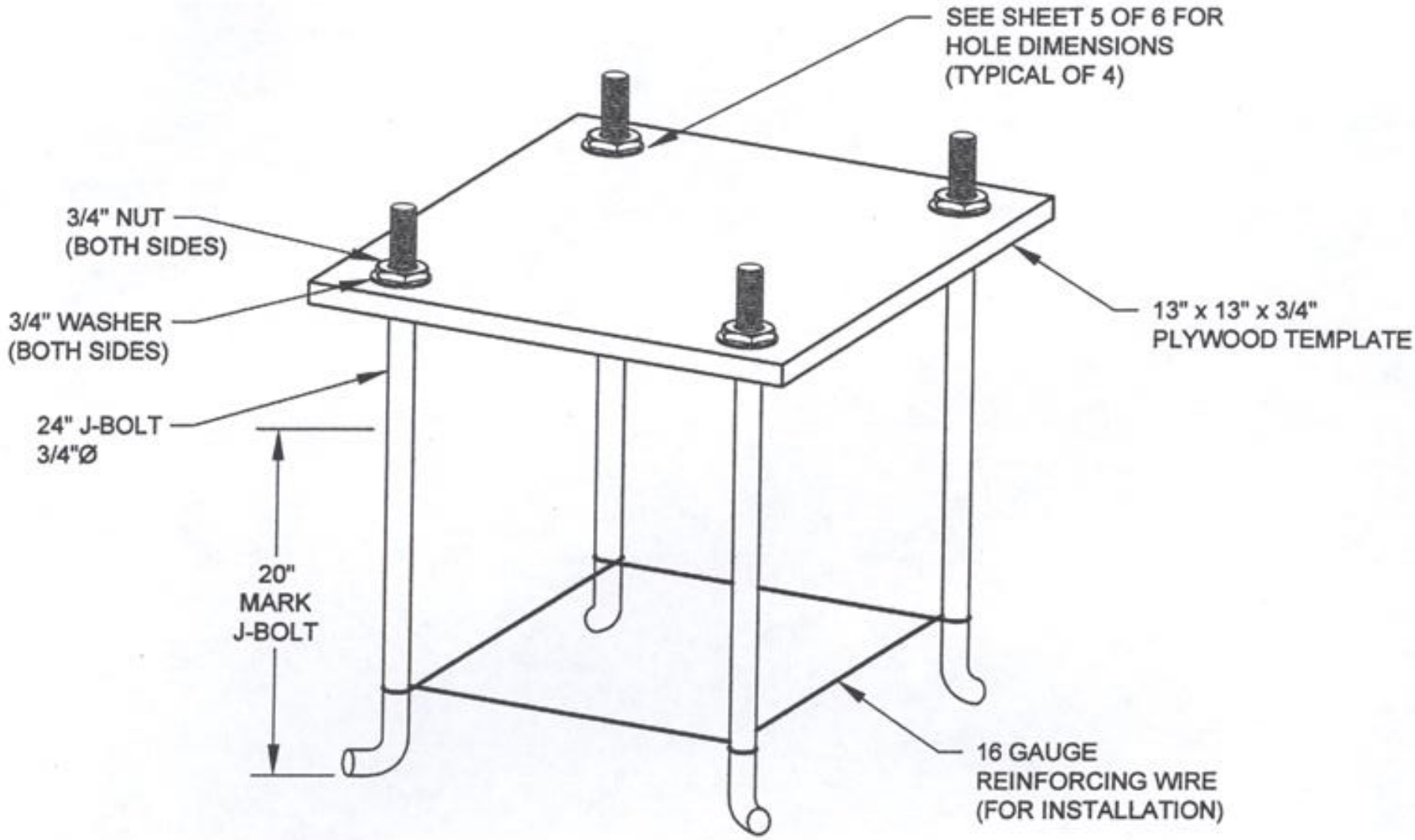
EARTHNET ENERGY

Title:
ENE GROUND-MOUNT PLATE FOUNDATION DETAIL

Scale: 3/4"=1'-0"	Drawn: TBM	Sheet: 3 OF 5



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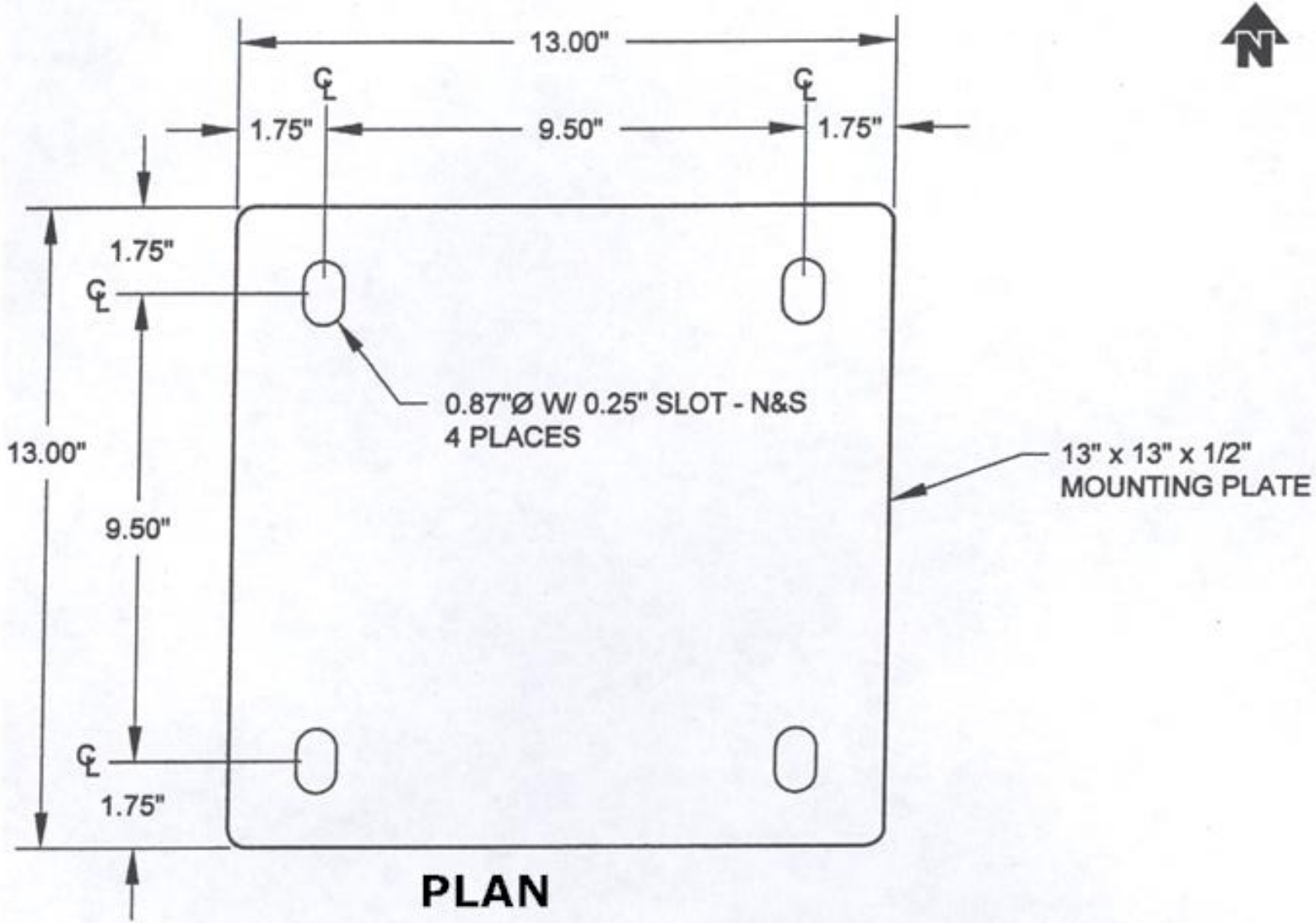
EARTHNET ENERGY

Title:

ENE TEMPLATE FOR GROUND-MOUNT PLATE BOLT PLACEMENT

Scale: NTS	Drawn: TBM	Sheet: 4 OF 5



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EARTHNET ENERGY

Title:
ENE GROUND-MOUNT PLATE BOLT PLACEMENT DETAIL

Scale: 3/4"=1'-0" | Drawn: TBM | Sheet: 5 OF 5

Appendix VI

Installation Instructions for ENE Solar Module 15260

Installation instructions

ENE Solar Module 15260

IMPORTANT!

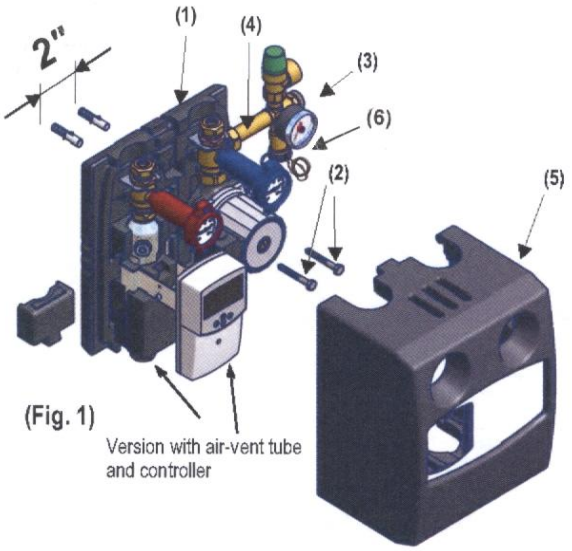
-Before commencing work, the installer must read, understand and observe this installation and operating manual.

-The solar modules are only to be assembled, installed and maintained by trained professionals. Personnel in training are only to work with the product under supervision of an experienced professional. Only under the above mentioned conditions does the manufacturer accept any liability according to the legal stipulations.

- All instructions in this installation and operating manual are to be observed when using the solar module. Any other mode of usage is inappropriate. The manufacturer accepts no liability for damage caused by inappropriate use of the solar module. Rebuilding, or making alterations, is prohibited for safety reasons. The solar module is only to be repaired by a repair service named by the manufacturer.

-The respective components delivered with the device vary according to type and equipment. Subject to technical modifications without notice!

Wall mounting



(Fig. 1)
Version with air-vent tube and controller

Mounting (Fig. 1)

- Remove front insulation cover (5).

-The solar module (1) forms a unit with the wall bracket and the rear insulation cover, and is to be fastened from the front side, in the prescribed position, with wall plugs and screws (2) suitable for the subsurface.

-Connect the safety assembly (3) (supplied separately with the module) to the outlet of the return flow fitting (4) above the pump using the G 3/4" union nut. The package accompanying the module contains a suitable gasket (6).

- Connect the system up to the solar energy circuit.

- After the system has been filled and a complete seal-tightness check performed, attach the front section of the heat insulation (5).

- **Removing the module from the wall bracket:** use a screwdriver or similar tool to pull the clamping rings off towards you.

Note: The ENE Solar module is now loose! Make sure that it does not slide forward and out of the wall bracket!

Sensor wires (3) included (1,000 ohm each)

- Orange high temp sensor wire (T-1) to be mounted under fire sleeve on discharge side of collector
- Grey sensor wires (T-2,3,4,5) applications
- Sensor wires can be extended using 18-2 shielded sensor wire

EARTHNET ENERGY®

Mounting the clamping ring screw connections

-Cut off the copper pipe at a right angle using a pipe cutter and debur the edges of the pipe.

-First push the clamping ring nut over the pipe, then the clamping ring.

-Insert the pipe with clamping ring nut and clamping ring into the screw connection and push up to the stop.

-Tighten the clamping ring nut by hand.

-When tightening the compression fitting, care is to be taken that counter-pressure is applied to the respective designated panes with an open-ended spanner.

Connection safety valve

- A blower line leading to a collection container (e.g. empty canister of the solar heating medium) must be fitted to the safety valve. This permits collection and reuse of any heating medium which escapes in the event of malfunction.

Heat insulation cladding

-The heat insulation cladding is for thermal insulation and protection during transport.

Connection plug for filling, flushing and draining

-Both the safety assembly and the FlowGuard are fitted with a mini ball-valve for filling, flushing and draining the system.

Safety assembly

-Consisting of safety valve, pressure gauge, fill-and-drain valve, and an expansion tank connection. In order to reduce the thermal load, the safety assembly is installed in the return flow line.

Installation instructions
ENE Solar Module 15260

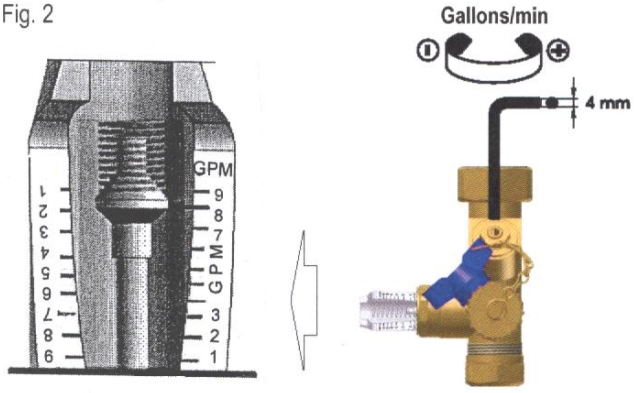
Flow volume adjustment (Fig. 2)
-The flow volume is set on the regulating valve using an SW 4 Allen Key.

-The set volume can be directly read on the scale.

-The valve stroke is spread over several spindle revolutions, thereby permitting a high level of setting precision.

-The setting values are based on the calculations for the system.

Fig. 2

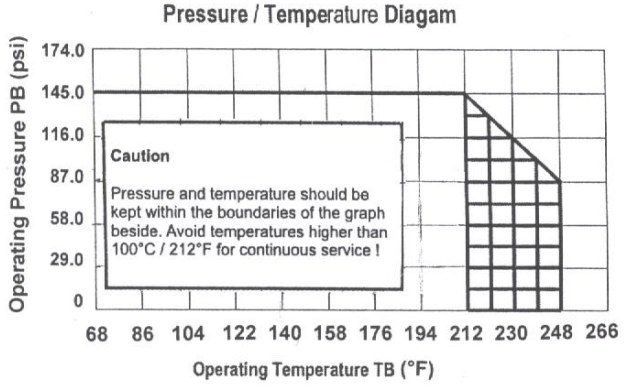


Gravity brake (Fig. 3)
-For filling, flushing and draining the system, the gravity brake must be open. It is opened by turning the ball valve to the 45° position. For normal operation of the system, the ball valve must be completely open.

Fig. 3

0° = ready for45° = open 90° = closed operation

Caution
Pressure and temperature should be kept within the limits shown in the adjacent diagram. Avoid temperatures higher than 212°F during continuous operation!



ENE No. 15260
Last revised: 10/1/2009
Subject to technical modifications

Torque for connections with flat seals
Torque values when tightening the screw connections using AFM 34 gaskets,thickness .08 inches:

3/4" Screw connection
1" Screw connection
1/4" Screw connection
1/2" Screw connection

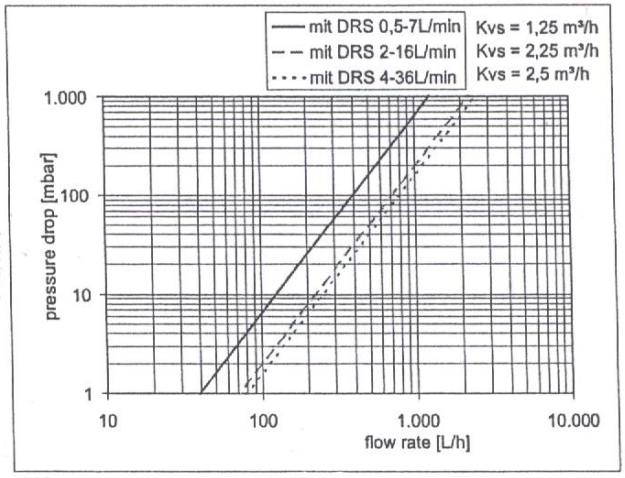
As the gasket may settle over time, it may be necessary for the customer to re-tighten the screw connections.

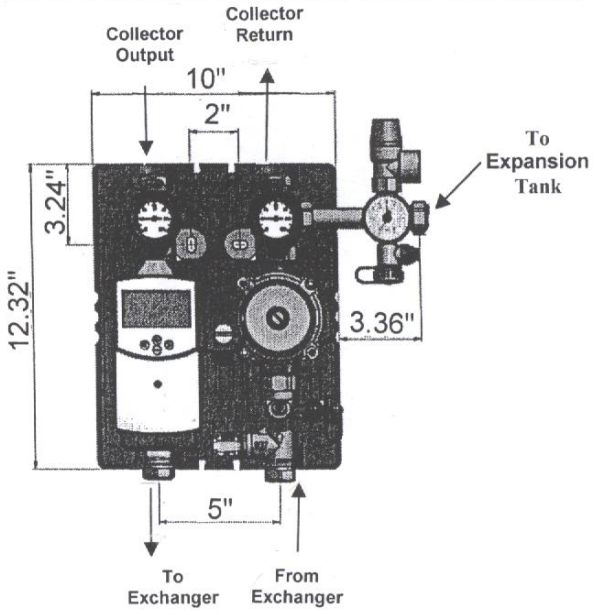
Technical data

Fittings	: hot-pressed brass, Ms58
Pipe systems	: precision pipes
Flowmeter	: high-grade impact-proof and temperature-resistant plastic
Spring - flowmeter	: stainless steel
Heat insulation cladding	: EPP

Materials

Max. adm. operating temperature : see Pressure/Temperature Diagram
Min. adm. operating temperature : 68°F
Max. adm. operating pressure : see Pressure/Temperature Diagram
Indicating accuracy -**WattFlow** : +10% of the meter reading





Appendix VII

ENE Control Module Manual

EARTHNET ENERGY®

Manufacturers of Solar Thermal Collectors and Systems

WARNING

Always disconnect the power supply before installing or servicing.

Read through these warnings and all installation instructions before beginning installation. Failure to do so can result in fire, shock, property damage, personal injury and/or death. Installation, operation, and maintenance must be performed by qualified personnel, in accordance with applicable codes, standards, and practices.

EarthNet Energy is not responsible for any damages or injuries that result from improper installation, modification, use or applications/configurations other than those detailed in this document.

TABLE OF CONTENTS

Features

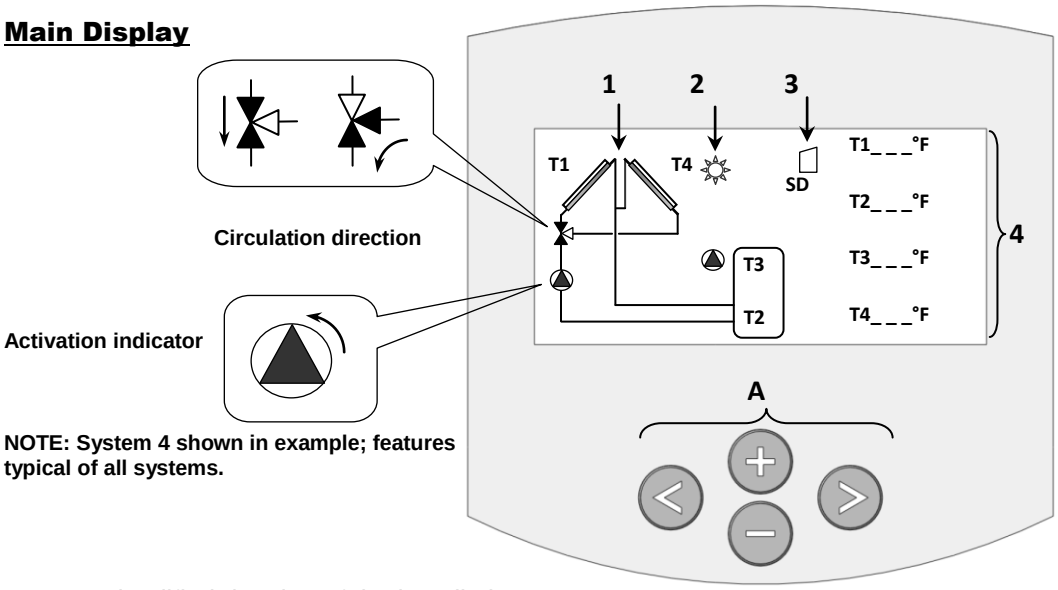
• Large graphic display with backlight
• Easy to use interface (4 keys with scroll menu)
• Several languages available
• System set-up/configuration option using SD card
• Record and view system data (Energy, pump operation etc.) with SD card interface
• Graphic view for temperature, energy etc.
• 5 system configurations with several extra functions possible
• 5 Temperature sensors (PT1000 type)
• 2 Pump outputs (Standard or variable speed)
• 2 Analog Grundfos sensor inputs (Flow and Pressure)
• 1 Impulse flow meter input (for energy measurement)
• Pump exercise function
• 1 Extra output (to control back-up heat, heat dump…)
• Automatic, Off or Manual Test mode
• Monitors system for errors (short or open circuits to sensors, pump failure)
• Choice of collector sensor location (external or internal to collector)
• Collector protection (Freeze and over heat)
• Permanent memory storage

Technical Features

Ambient temperature range for normal operation	32°F – 122°F
Electrical Protection **Installation Category** **Pollution Degree**	IP20 II 2
Fuse **Power supply** **Maximum Power Consumption (**with all outputs activated**)**	5A 120Vac (5x20mm) 120Vac +/- 10% 60Hz 4.2A (~504W)
Outputs: **P1** (Main pump with standard or PWM speed regulation): **P2** (Pump with standard or PWM speed regulation, Booster pump, valve): **P3** (Extra, Additional heat, cooling…)	 Triac 1.0A 120VAC. Triac 1.0A 120VAC Relay 2A 120VAC
Inputs: **T1** (Collector1): **T2** (Tank1): **T3** (Extra sensor): **T4** (Extra sensor, Tank2, Collector2): **T5** (Collector return): **T6** (Flow meter): **GDS1** (Grundfos Flow meter): **GDS2** (Grundfos Pressure sensor):	 PT 1000 type PT 1000 type PT 1000 type PT 1000 type PT 1000 type Impulse type (low voltage 5V) Analog type (Grundfos **VFS**) Analog type (Grundfos **VPS**)
Sensors delivered: **1 Collector sensor** **1 Tank** **1 Extra**	 PT1000 (1.5M 356°F) PT1000 (3M 221°F) PT1000 (3M 221°F)
Software version	Displayed during the start-up **Version xxxxxx**

DISPLAY (Screen, Keys, Menus)

Main Display



NOTE: System 4 shown in example; features typical of all systems.

1: Simplified drawing of the installation.
- The pump symbols turn when pumps are activated.
- The filled triangles on the valve symbol indicate the circulation

2: Solar storage is working.

3: SD card storage is active.

4: Sensor temperature readings, pump speed indicators, power and stored energy levels.

A: Keypad description

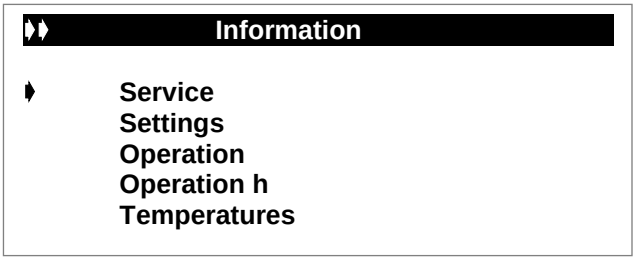
⊕ Navigation key up or plus key

⊖ Navigation key down or minus key

› Navigation key right

‹ Navigation key left

Main menu:



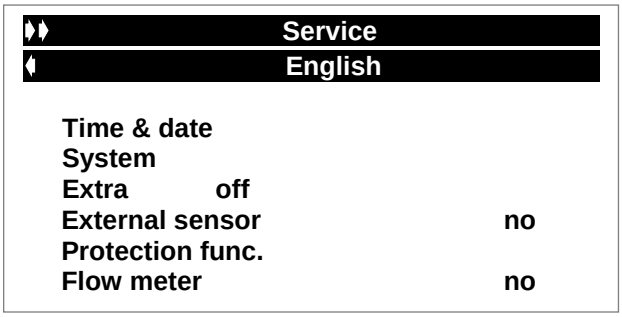
Press › to enter the Navigation Menu.
(The active menu is highlighted in black at the top of the display)
Use the ⊕ or ⊖ buttons to navigate in the menus. The selection cursor (◗) will indicate the current submenu.
Press › to enter the selected menu and/or ‹ to return to the previous menu.

IMPORTANT NOTE: Not all submenus, selections, or options discussed in this manual are available on all systems. Depictions of menus and submenus shown here are representative of their actual appearance on the control when the same series of settings as is described is followed.

1 Service Menu

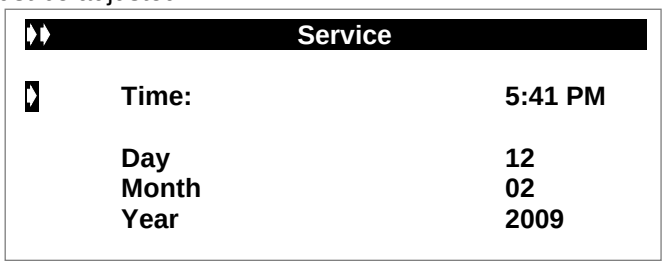
1.1 Language:

- With (**+**) or **(-)**select the line "**English**" and press **(>)** to highlight the line.
- Now you can change the language with (**+**) or **(-)**, you have the choice between: English, Deutsch, Français, Svenska, Spanish..



1.2 Time & Date:

- With (**+**) or **(-)** select the line "**Date & Time**" and press **(>)** to enter in the submenu time & Date.
- Now you can select the date or time line with **(+)** or **(-)**, then press **(>)** to highlight the value which must be adjusted.



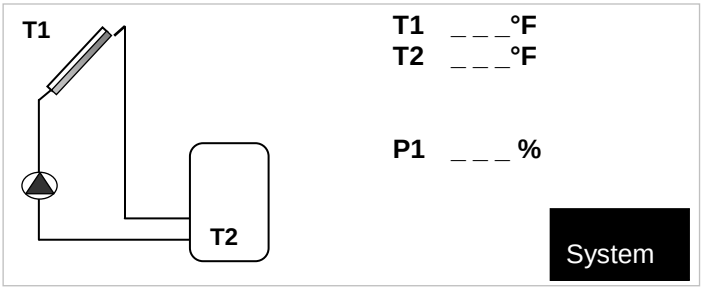
Note: If power supply is lost, settings will be retained for 24 hours; after that time, the clock will have to be reset.

1.3 System:

When the line is selected, press **(>)** to enter the submenu.
You have the choice between 5 systems with the option to add an extra function (see **1.4**).

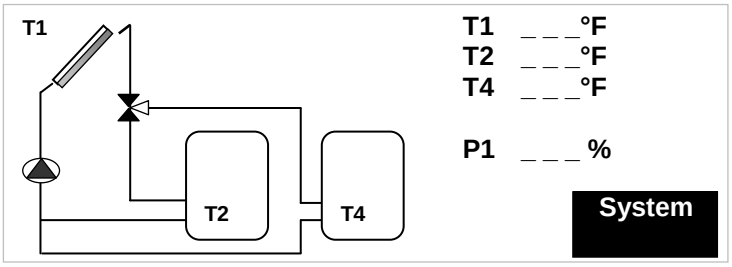
1.3.1 System 1

Basic system, with 1 tank, 1 pump, 1 collector array and 2 sensors.
With this system you can add extra functions with 1 or 2 sensors (**Booster pump**, **Thermostat**, **Cooling** or **Diffcontrol** function).



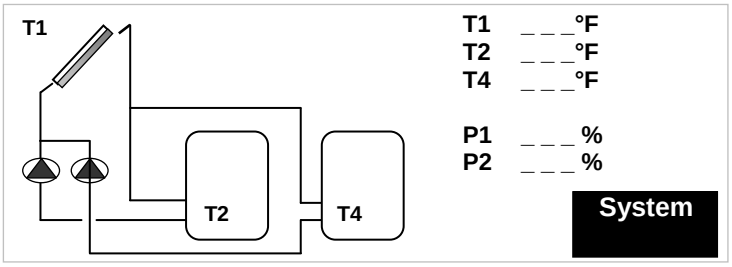
1.3.2 System 2

System with 2 tanks, 1 pump, 1 valve, 1 collector array and 3 sensors.
With this system you can add an extra function with 1 sensor (**Thermostat**, or **Cooling** function).



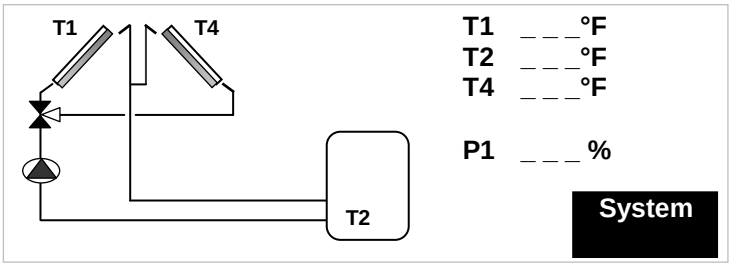
1.3.3 System 3

System with 2 tanks, 2 pumps, 1 collector array and 3 sensors.
With this system you can add an extra function with 1 sensor (**Thermostat**, or **Cooling** function).



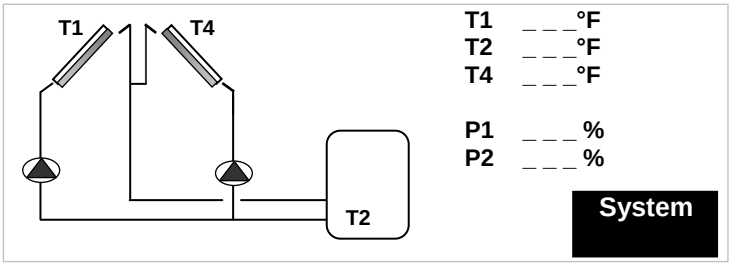
1.3.4 System 4

System with 1 tank, 1 pump, 1 valve, 2 collector arrays with 2 different cardinal directions (East / West) and 3 sensors. With this system you can add an extra function with 1 sensor (**Thermostat**, or **Cooling** function).



1.3.5 System 5

System with 1 tank, 2 pumps, 2 collector arrays with 2 different cardinal directions (East / West) and 3 sensors. With this system you can add an extra function with 1 sensor (**Thermostat**, or **Cooling** function).



1.4 Extra:

When the line is selected, press **(>)** to highlight the line.
You have the choice of 3 extra functions
(The choice is not the same with all systems, see the previous section)

1.4.1 Thermostat Function

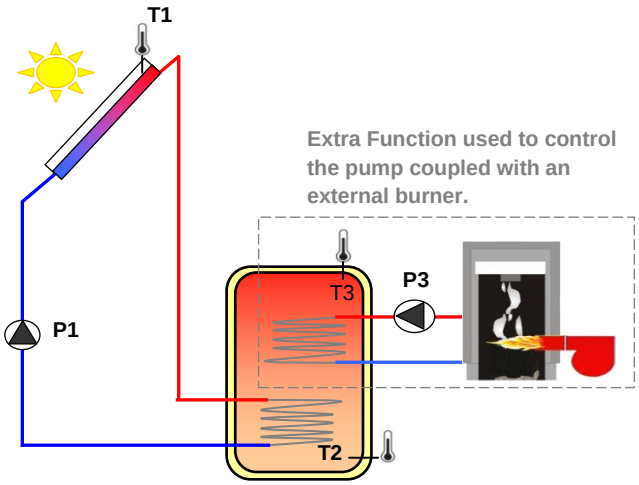
This function may be used to connect an auxiliary or back-up heat source to your system.

Some possible auxiliary heat sources:

- Pump controls for Fuel or Gas burner (P3 provides 120V signal)…
- Electrical element inside the solar tank.

  NOTE: If electrical usage exceeds rated capacity of **P3** (2A maximum) an external relay must be used.

Example:

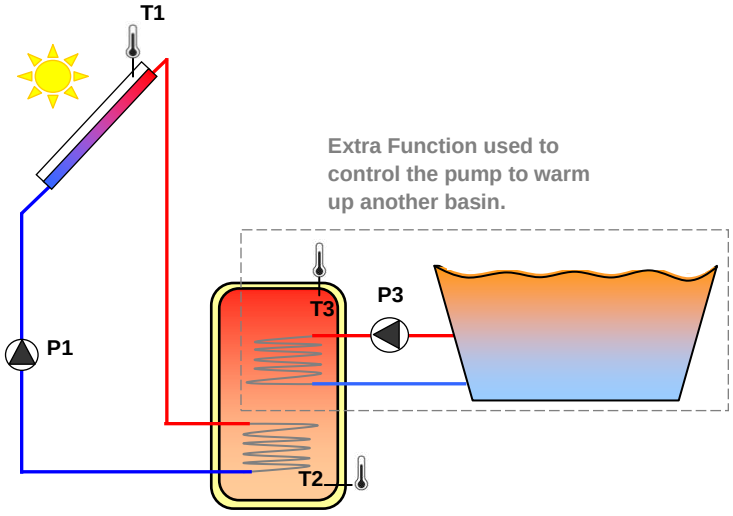


•This function is available only if selected on the Extra Menu

1.4.2 Cooling Function

The cooling function may be used to cool down the primary solar tank during times of high solar irradiation. This function allows for the accumulation of excess energy in another heat storage area/device (Swimming pool, additional tank or heat sink).

Example:

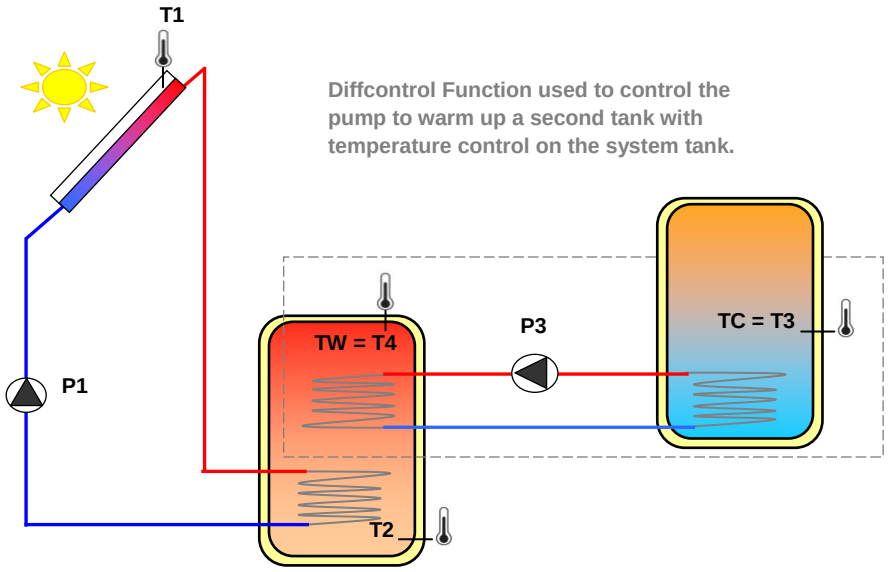


•This function is available only if selected on the Extra Menu

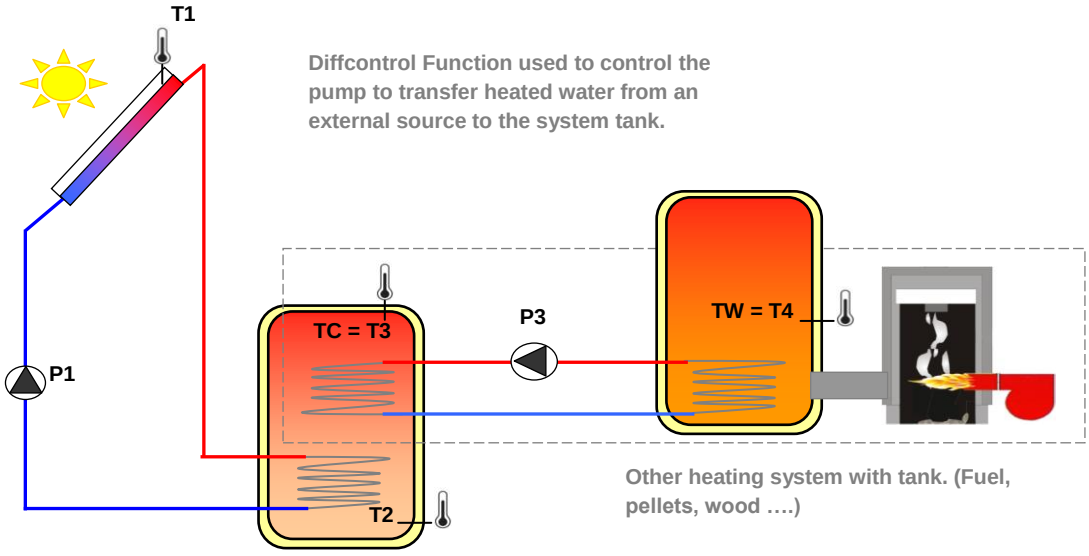
1.4.3 Diffcontrol Function:

The **Diffcontrol** function (only available on **System 1**) may be used to transfer heated water from one storage tank to another independent of the solar collecting function.
This extra function allows separate temperature control of both tanks with user-defined temperature settings (see **Settings** menu / **2.13**).

Example #1 Additional tank w/no auxiliary heat source



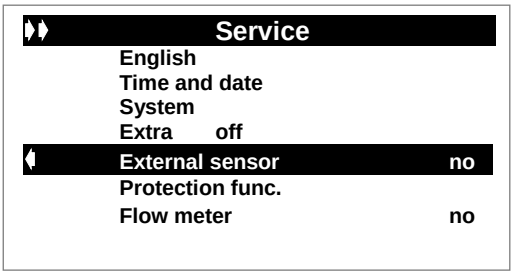
Example #2 Additional tank w/auxiliary heat source



•This function is available only if selected on the Extra Menu

1.5 External Sensor:

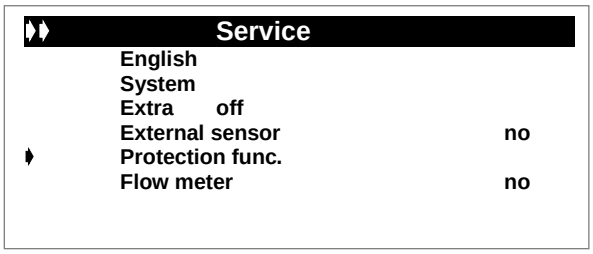
This option is useful for collectors that require the sensor to be mounted on the piping external to the collector manifold.



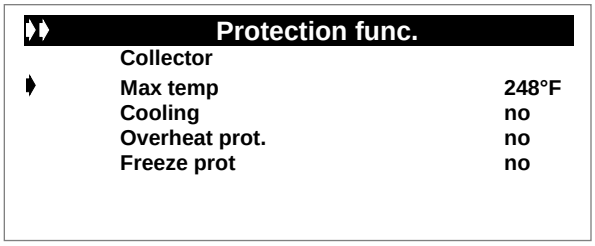
Select **External sensor** and press **(>)** to highlight the line.

- Now select **yes** [using the **(+)** or **(-)** keys] if the collector sensor is not mounted directly on the collector (e.g. on the return pipe). This function will energize the collector pump for 30 seconds twice per hour to ensure that the collector fluid temperature is accurately measured and avoid collector short cycling.

1.6 Protection function :



- Once the line is selected, press **(>)** to enter the submenu.



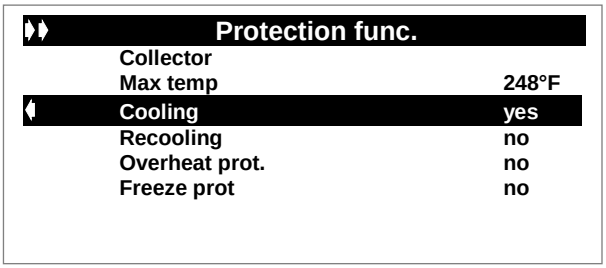
The **Maxtemp** setting is used in the following three protection functions which are designed to prevent overtemp in the collectors. If one or more of the protection functions are activated, the system will automatically activate when the collector temperature reaches the **Maxtemp** threshold regardless of the tank temperature settings.

(**Maxtemp** is adjustable from 230°F to 302°F with factory default set at 248°F)

For safety, however, the pumps will automatically shut down when the water temperature in the tank reaches 203°F.

Code listed and approved hot water tempering valves should be installed throughout the system to ensure that water temperatures at the points of use are within a safe and acceptable range.

1.6.1 Cooling:



This option is for the protection of the collector fluid. It activates the solar pump (**P1** or **P2)** if the temperature on the collector arrays (**T1** or **T4)** exceeds the collector **Max temp** value even if the set maximum temperature in the tank is exceeded. The circulation stops when temperature has dropped 20°F.
(The pumps will be stopped if the water temperature in the tank reaches 203°F).

- When **Yes** is selected on the **Cooling** function, the **Recooling** function becomes accessible.

1.6.1.1 Recooling

When **Recooling** is set to YES, the following safeguards are in place:
When the water temperature inside the tank is above **Maxtemp tank1** (refer to section 2.1) and the collector temperature is 20°F lower than the actual tank temperature (**T2**), the pumps will activate to cool the tank through the collector array (typically at night).

The pumps will run until either

- the temperature of the tank drops below the **Maxtemp tank1** setting, or,
- the temperature difference between the tank and the collector array is less than 4°F.

1.6.2 Overheat protection *(should only be used in conjunction with Cooling function)*:

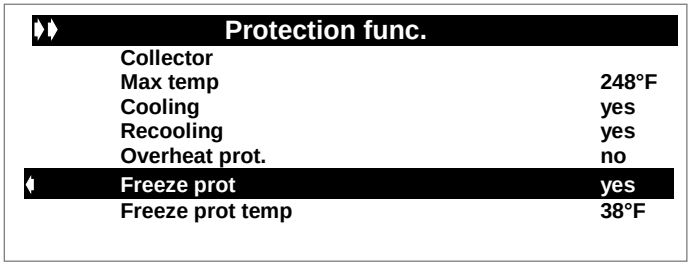
When set to **YES**, this function will stop all collector circulation (**P1** and **P2**) when the collector temperature registers more than 20°F above the collector **Maxtemp** setting. This function is intended to protect any temperature sensitive system components (Tank, lines, pumps...) in the event of the failure of, for example, tank sensor **T2.**

1.6.3 Freeze protection:

When set to **YES**, this option will keep the solar panel temperature (**T1** or **T4)** above the **Freeze Protection Temperature** setting level (see below) by activating the pump (**P1** or **P2)**.

- This option could be used to reduce snow accumulation on the panel for increased efficiency during the day or to avoid potential damage due to freezing.

Note: This function uses energy from the storage tanks and may result in reduced available thermal capacity.

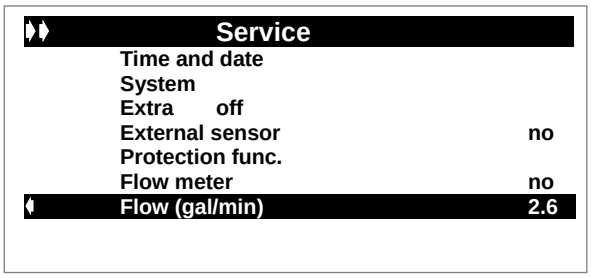


- Use **(+)** or **(-)** to select the **Freeze prot.**
- Press **(>)** to select.
- Use the **(+)** or **(-)** buttons to select **yes**.

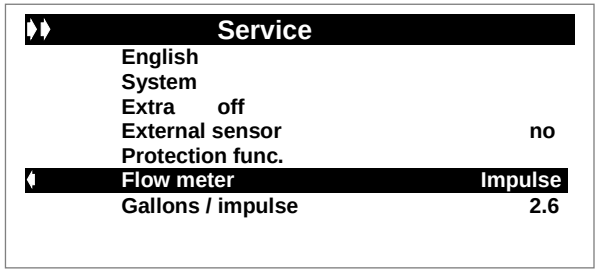
- Adjust the **Freeze prot temp** setting to the desired temperature.
  (Adjustable from -4°F to + 45°F with factory default of 0°F)

1.7 Flow meter:

The flow meter is used for energy measurement and system monitoring.
If no flow meter is installed (factory default setting) you must manually enter the pump flow in gallons/minute using the **(+)** or **(-)** buttons.
(Adjustable from 0.1 to 26.4 gal/min with factory default set at 2.6 gal/min)
The flow can also be approximated from a mechanical flow meter (if installed).



- If impulse flow meter is installed (on **T6 / PF**) select "**impulse**", then you must enter with **(+)** or **(-)** the flow meter characteristics in gal / impulse. (Adjustable 0.26 to 6.6 gal/imp with factory value 2.6 gal/imp)



Flow Monitoring

System flow is monitored whether or not a flow meter is installed.
If no flow meter is installed

- the difference between collector temperature and tank temperature is used as indication of an error in the flow.
- A difference of greater than 140°F for more than 30 minutes is interpreted as an error.

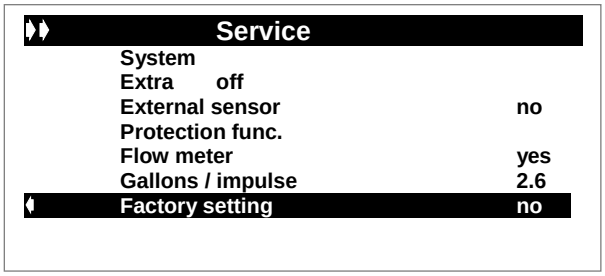
When a flow meter is installed

- If no flow has been measured for ten minutes after the pump engages, an error is indicated.

When an error is detected, an error message is shown in the display.

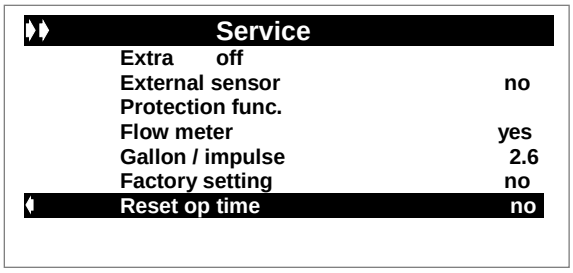
1.8 Reset to Factory default settings:

- Press **(>)** to highlight this line if you want to reset all settings to their factory default.
- Select "**yes**" with **(+)** key.
- Press **(<)** repeatedly to return to the main menu.
- All settings are now returned to factory defaults.



IMPORTANT NOTE: The factory default setting on the **Operation Menu** is **OFF.** This prevents system components (**P1**, **P2**, **P3**) from operating until system is set up. To turn on the system, change the setting to **AUTOMATIC (Active)**. See **Operation** menu / **3.1** for further info.

1.9 Reset op time:

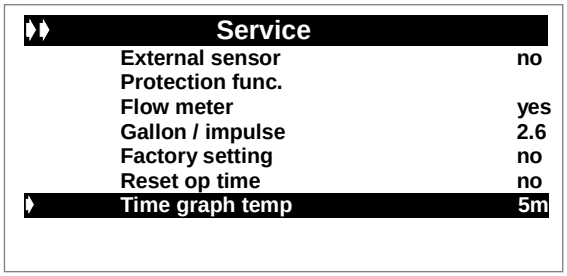


To reset the all of the operation hours to zero:
Press **(>)** to highlight the line.
Select "**yes**" with **(+)** key.
Press **(<)** repeatedly to return to the main menu.

Caution:
This will erase all previously recorded data (Power, Energy, temperature…)

1.10 Time graph temp:

Adjusts the graphical scale for the Temp vs. Time graphs (adjustable from 1 to 60 minutes).

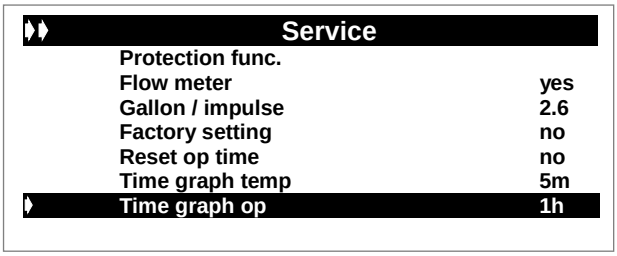


See **Temperature (section 5)** for more detailed information.

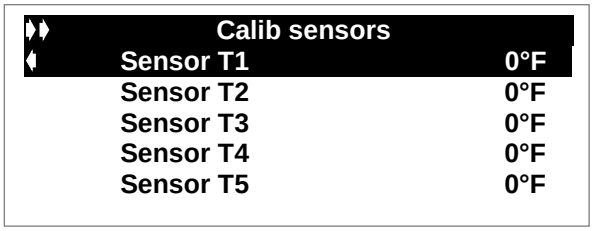
1.11 Time graph op:

Adjusts the graphical scale for the **Operation h menu** vs. time graphs (adjusts from 1 to 48 hours).

See **Operation h (section 4)** for detailed information.



1.12 Calibration of sensors:



On this submenu you can calibrate all the temperature sensors connected to your system.

CAUTION: Check the temperature with a calibrated thermometer before adjusting.

(Calibration range is from -6°F to +5°F with factory default setting of 0°F)

1.13 US Version:

This selection allows you to select the units of measurement that will be displayed on the control.

Service	
Gallon/impulse	2.6
Factory setting	no
Reset op time	no
Time graph temp	5m
Time graph op	1h
Calib sensors	
US version	yes

YES = (US Version): °F, 12H am/pm, Gallons, BTU/h and kBTU
NO = (EU Version): °C, 24H, Litres, kWh

1.14 Pump P1

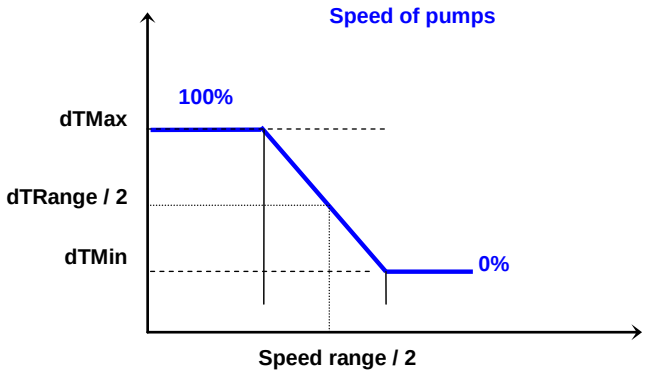
This function allows you to choose the type of the pump control used on the output **P1**.
To change the pump type, press **(>)** then select your choice with the (**+**) or (**-**) buttons.

Service	
Factory setting	no
Reset op time	no
Time graph temp	5m
Time graph op	1h
Calib sensors	
US version	yes
Pump P1	No SC

There are 3 choices:

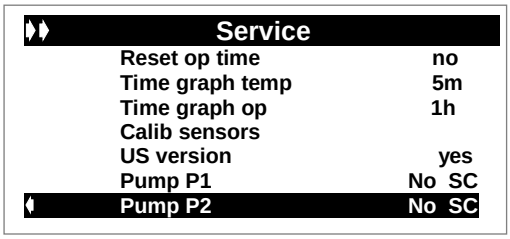
- **No SC** - For standard pump without speed control.
- **Phase SC (PhAC SC on Display)** - For standard pump with speed control.
  - The speed regulation is done by TRIAC (phase control).
  - Check the following before changing the setting:
    - Whether or not your pump will work with this type of speed regulation,
    - The minimum speed rating of the pump, and,
    - The speed selector on your pump must be put on the maximum position.
    - See Section **2.8 Min rev pump** for further applicable settings and information.
- **PWM SC** - For PWM pump with speed control.
  - The speed regulation is done by PWM control.
    - Available with GRUNDFOS SOLAR PM type.

Note: If you have selected **PWM SC** on the **Pump P1** or **Pump P2**, the pump speed will begin to decrease when the **dT** value is under the **dTMax** setting for the appropriate tank. At the applicable **dTmin** setting, the pump will shut off.



1.15 Pump P2

This function allows you to choose the type of the pump used on the output **P2**.
To change the pump type, press **(>)** then select your choice with the (**+**) or (**-**) buttons.



Pump P2 settings are the same as described in the previous section for **Pump P1** (**No SC**, **Phase SC**, **PWM SC)**.

In addition, Pump P2 offers a **Boost** setting for use with a booster pump, commonly used in drainback systems. This setting should be used when a second pump is installed in series on the primary circuit to assist **Pump P1** at system start-up.

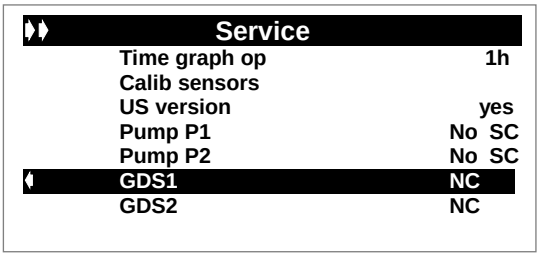
Run time for the booster pump can be adjusted on the **Setting** menu (see **Setting / 2.9 Boost time**).

Important Note: Boost is only available for **System 1** (see **1.3.1 System 1**)

1.16 GDS1:

Your controller has 2 special inputs for analog GRUNDFOS sensors (Type VFS Flow sensor or VPS pressure sensor).

- The Flow sensor is used for energy measurement and monitoring
- The Pressure sensor is used only to monitor the pressure on the primary circuit.



GDS1 may be connected to either a flow or pressure sensor.

Four different GF Flowsensor models are supported by **GDS1:**

VFS1 - 12 l/min	(3.2 gal/min)	Flow sensor
VFS 2 - 40 l/min	(10.6 gal/min)	Flow sensor
VFS 5 - 100 l/min	(26.4 gal/min)	Flow sensor
VFS 10- 200 l/min	(52.8 gal/min)	Flow sensor

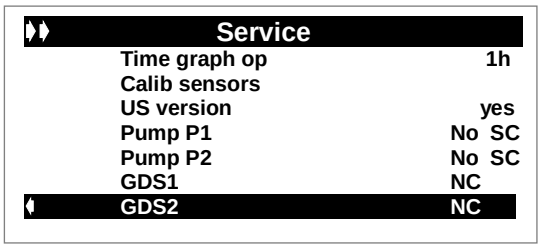
Three different GF Pressures sensor models are supported by **GDS1**:

VPS 0 – 4 bar	(58 psi)	Pressure sensor
VPS 0 – 6 bar	(87 psi)	Pressure sensor
VPS 0 – 10 bar	(145 psi)	Pressure sensor

- To change the sensor type, press **(>)** then select either your choice or **NC** (Not Connected) with the (**+**) or (**-**) buttons

You can also check the operation of the sensor on the submenu **3.2 Manual testing**.
See the controller schematic for more information on the electrical connection.

1.17 GDS2:



This input is reserved for connection of a Pressure sensor to monitor the primary circuit.
Three GF Pressure sensors are supported on the **GDS2** port:

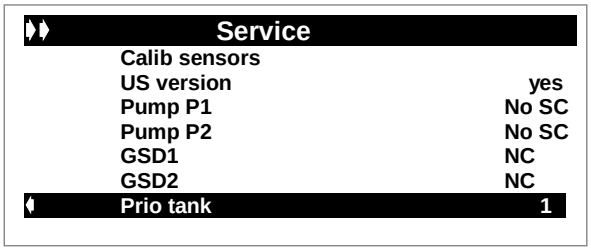
VPS 0 – 4 bar (58 psi)	Pressure sensor
VPS 0 – 6 bar (87 psi)	Pressure sensor
VPS 0 – 10 bar (145 psi)	Pressure sensor

- To change the sensor type, press **(>)** then select either your choice or **NC** (Not Connected) with the (**+**) or (**-**) buttons

You can also check the operation of the sensor on the submenu **3.2 Manual testing**.

See the controller schematic for more information on the electrical connection.

1.18 Priority Tank:



This option will only display if you are configuring a system with two tanks (as discussed in sections **1.3.2 / System 2** and **1.3.3 / System 3**)

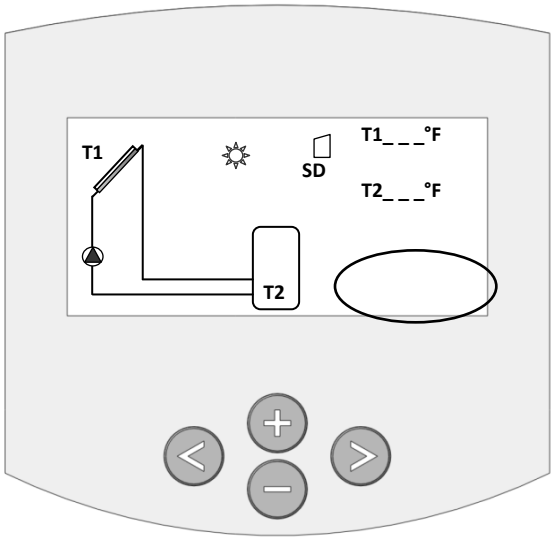
Designate one of the system tanks as **priority** (**tank1** or **tank2**). The **priority** tank will always be activated first unless one of the following situations occur.

The second tank will become operational when:

The **priority** tank reaches the **Maxtemp** value entered on the **Setting** menu (**Section 2**) for that particular tank (if **tank1** is designated **priority**, the applicable setting will be the **Maxtemp tank1**; if **tank2** is **priority**, **Maxtemp tank2**).

Note: When the temperature in the **priority** tank falls below the temperature set for **MinTemp Prio** (**Setting** menu / **2.7 Mintemp prio tank**), **priority** will switch back from the second tank to the original **priority** tank.

1.19 Energy Measurement



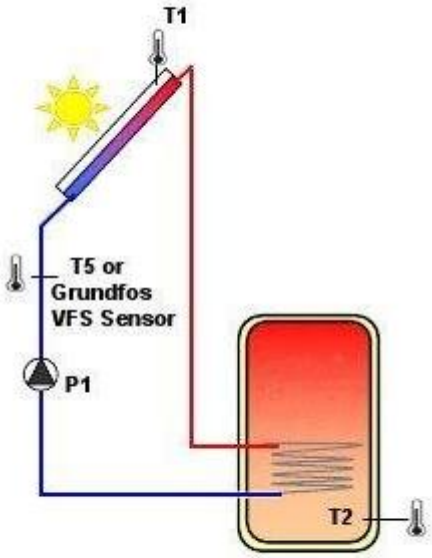
The Advanced Solar Control has multiple options for measuring energy. Both instantaneous energy (**kBTU/h**) and accumulated energy (**kBTU**) are displayed on the **Main Display** screen.

Energy is calculated using ΔT, flow, and fluid constants. Flow can either be input by the user or measured by various types of flow sensors. The Advanced Solar Control has multiple options for which ΔT is used.

Option #1 (Typical)

ΔT is measured using sensors **T1** (Collector array) and **T2** (Tank).

Option #2



The **T5** sensor should be installed in the supply line to the Collector array. The Advanced Solar Control will then automatically use the ΔT between **T1** and **T5** to calculate energy. The ΔT between **T1** and **T2** will still be used to activate the pump.

To see the actual temperature being registered by the **T5** sensor, go to the **Operation** menu, select **Manual testing**, and check the reading there. The **T5** sensor and its information will not appear on either the **Temperatures** menu or the **Main Display** screen.

Option #3

Install a Grundfos VFS Sensor in the supply line to the Collector array. The energy measurement will be calculated using the flow and temperature recorded by the Grundfos sensor and the readings of the Collector array sensor (**T1**). System configuration for the Grundfos VFS Flow sensor is discussed in section **1.16 GDS1**.

2 Setting Menu:

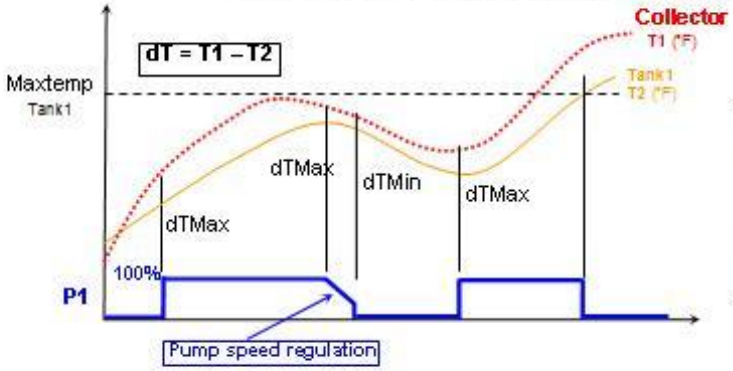
This menu allows you to set all adjustable parameters of your system.
Not all options are available with all systems.

Settings	
Maxtemp tank1	
dT Max tank1	49°F
dT Min tank1	38°F
Maxtemp tank2	149°F
dT Max tank2	49°F
dT Min tank2	38°F
Min rev pump	100%

2.1 Maxtemp tank1:
Maximum value of desired water temperature in **tank1** during normal operation.
(Adjustable from 59°F to 203°F with factory default set at 149°F)

2.2 dTMax tank1:
Difference (ΔT) between collector temperature (**T1**) and **tank1** temperature (**T2**) that will automatically engage **pump1**.
(Adjustable from 7°F to 72°F with factory default set at 12°F)

2.3 dTMin tank1:
Difference (**ΔT**) between collector temperature (**T1**) and **Tank1** temperature (**T2**) that will automatically disengage **pump1**.
(Adjustable from 4°F to 63°F with factory default set at 5°F)
NOTE: dTMin will always be 3-7°F less than dTMax



Note: If the installed system has two tanks, the adjacent graph is also valid when using the sensor information from the second tank

2.4 Maxtemp tank2: *Only applicable on systems with two tanks (as discussed in sections **1.3.2 / System 2** and **1.3.3 / System 3**).*
Sets the maximum value of desired water temperature on the **tank2**.
(Adjustable from 59°F to 203°F with factory default set at 149°F)

2.5 dTMax tank2: *Only applicable on systems with two tanks (as discussed in sections **1.3.2 / System 2** and **1.3.3 / System 3**).*
Difference (**ΔT**) between collector temperature (**T1**) and **tank2** temperature (**T4**) that will automatically engage **pump1** with **system2** or **pump2** with **system3**.
(Adjustable 7°F to 72°F with factory default set at 12°F)

2.6 dTMin tank2: *Only applicable on systems with two tanks (as discussed in sections **1.3.2 / System 2** and **1.3.3 / System 3**).*
Difference (**ΔT**) between collector temperature (**T1**) and **tank2** temperature (**T4**) that will automatically disengage **pump1** with **system2** or **pump2** with **system3**.
(Adjustable from 3°F to 63°F) with factory default set at 5°F)
NOTE: dTMin tank2 will always be 3-7°F less than dTMax tank2

2.7 Mintemp prio tank:

This will only display on systems configured with two tanks (as discussed in sections **1.3.2 / System 2** and **1.3.3 / System 3**)

Settings	
Maxtemp tank1	149°F
dT Max tank1	49°F
dT Min tank1	38°F
Maxtemp tank2	149°F
dT Max tank2	49°F
dT Min tank2	38°F
Min temp prio tank	85°F

This option allows the user to define the minimum temperature setting for the **priority** tank (as designated in the process described in the **Service** menu / **1.18 Priority Tank**). When the temperature in the **priority** tank falls below this setting, the system will switch back from the second tank (temporarily deemed **priority** due to overheating in the main tank) to the original **priority** tank.
(Adjustable from 32°F to the **MaxTemp** tank setting for the **priority** tank with factory default set at 32°F)

2.8 Min rev pump:

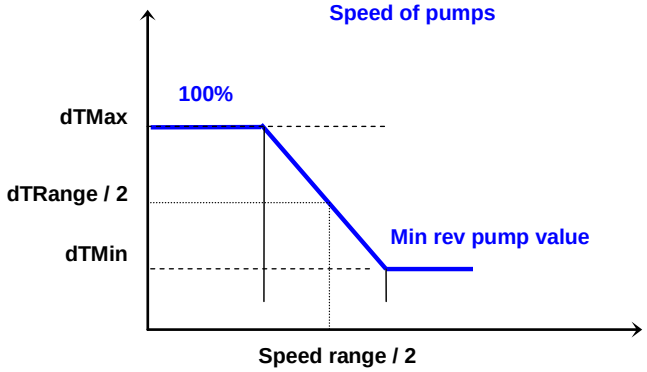
This option will only display if Phase Speed Control (**Phase SC**) is selected on the **Service** menu **1.14 Pump P1** or **1.15 Pump P2**.

Settings	
Maxtemp tank1	149°F
dT Max tank1	49°F
dT Min tank1	38°F
Maxtemp tank2	149°F
dT Max tank2	49°F
dT Min tank2	38°F
Min rev pump	100%

- Highlight **Min rev pump** and press **(>)**
- Use the **(+)** or **(-)** buttons to set the minimum speed of the pumps
  (Adjustable from 30% to 100% with factory default set at 100%)

WARNING: Setting Min rev pump below 50% may prevent pump operation under various conditions (e.g. high head pressure due to system design or cold/degraded glycol solution).

The speed of the pump will start to decrease when the **dT** value is under the **dTMax** setting for the appropriate tank; the **Min rev pump** setting will come into effect at the applicable **dTmin** setting.

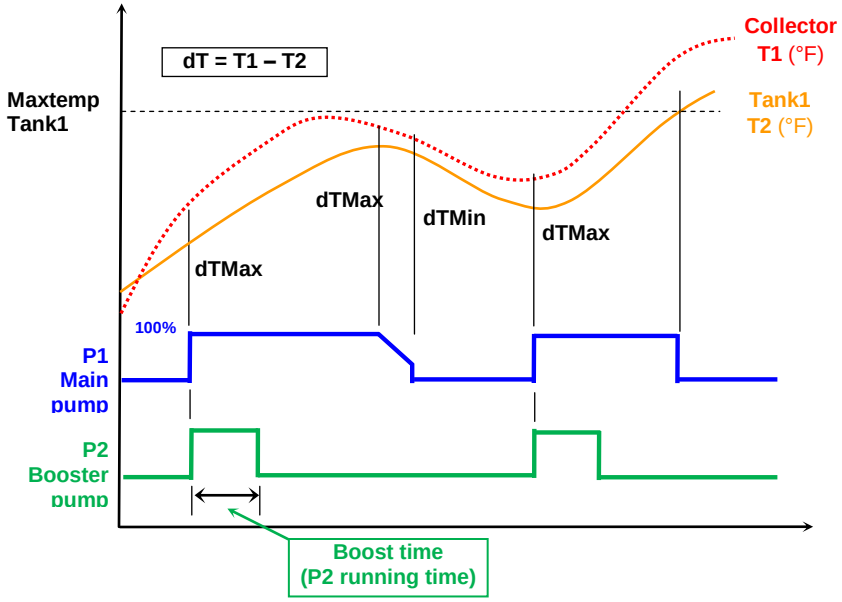


2.9 **Boost time:** *Available for System 1 only*

This option will display only if the **Boost** setting is chosen for **Pump P2** on the **Service** menu / **Pump P2** (See Section **1.15**).

Settings	
dT Max tank1	49°F
dT Min tank1	38°F
Maxtemp tank2	149°F
dT Max tank2	49°F
dT Min tank2	38°F
Min rev pump	100%
P2 Boost time	5min

- Highlight **P2 Boost time** and press **(>)**
- Use the **(+)** or **(-)** buttons to set the duration for the running time of P2
  (Adjustable from 1 to 10 minutes with factory default set at 5 minutes)



2.10 **Mintemp Collector**:

This option allows you to set the minimum collector temperature required for solar loading.
(Adjustable from -9°F to 210°F with factory default set at -9°F)

Settings	
Maxtemp tank2	149°F
dTMax tank2	49°F
dT Min tank2	38°F
Min rev pump	100%
Mintemp prio	85°F
Mintemp coll.	32°F

EXTRA FUNCTIONS

The following three options are only available if you have made the corresponding selection on the **Service / Extra** menu discussed in Section **1.4.**

2.11 Thermostat Function:

Service	
English	
Time and date	
System	
Extra	thermostat
External sensor	no
Protection func.	
Flow meter	no

2.11.1 Start:

When the water temperature at the top of the system tank (**T3**) falls below this setting, **P3** will engage and start to transfer additional heat from the external tank or heat source.

(Adjustable from 68°F to 194°F with factory default set at 104°F)

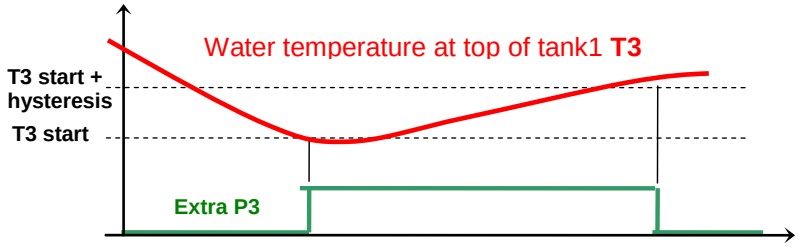
Settings	
dT Max tank1	49°F
dTMin tank1	38°F
Maxtemp tank2	149°F
dT Max tank2	49°F
dT Min tank2	38°F
Min rev pump	100%
Thermostat Start	104°F

2.11.2 Hysteresis:

When the water temperature at the top of the system tank (**T3**) exceeds the **Start** temperature (see **2.11.1** above) plus the **Hysteresis** setting, **P3** will disengage.

(Adjustable from 3°F to 54°F with factory default set at 18°F)

Settings	
dTMin tank1	38°F
Maxtemp tank2	149°F
dT Max tank2	49°F
dT Min tank2	38°F
Min rev pump	100%
Thermostat Start	104°F
Thermostat Hyst	12°F



2.12 Cooling Function:

Service	
English	
Time and date	
System	
Extra	cooling
External sensor	no
Protection func.	
Flow meter	no

2.12.1 Cooling start:

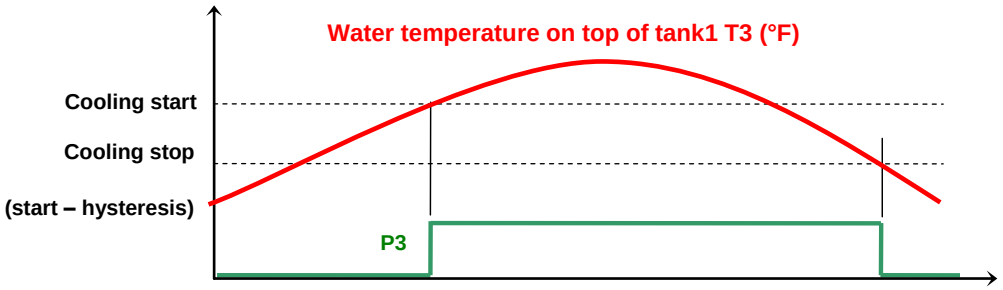
When the water temperature in the top of the system tank (**T3**) rises above this setting, **P3** will activate to start cooling the tank by transferring water to the external tank or heat sink.
(Adjustable from 68°F to 194°F with factory default set at 104°F)

Settings	
dT Max tank1	49°F
dTMin tank1	38°F
Maxtemp tank2	149°F
dT Max tank2	49°F
dT Min tank2	38°F
Min rev pump	100%
Cooling Start	104°F

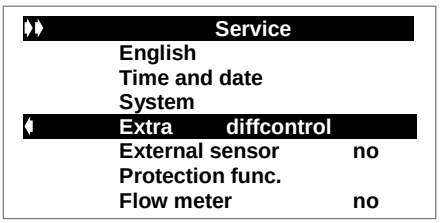
2.12.2 Cooling hyst:

When the water temperature at the top of the system tank (**T3**) falls under the **Start** temperature (see **2.12.1** above) minus the **Hysteresis** setting, **P3** will disengage.
(Adjustable from 3°F to 54°F with factory default set at 18°F)

Settings	
dTMin tank1	38°F
Maxtemp tank2	149°F
dT Max tank2	49°F
dT Min tank2	38°F
Min rev pump	100%
Cooling Start	104°F
Cooling Hyst	12°F



2.13 Diffcontrol Function:



For systems with an additional tank but <u>without</u> an auxiliary heat source (Service/1.4.3 Example #1)

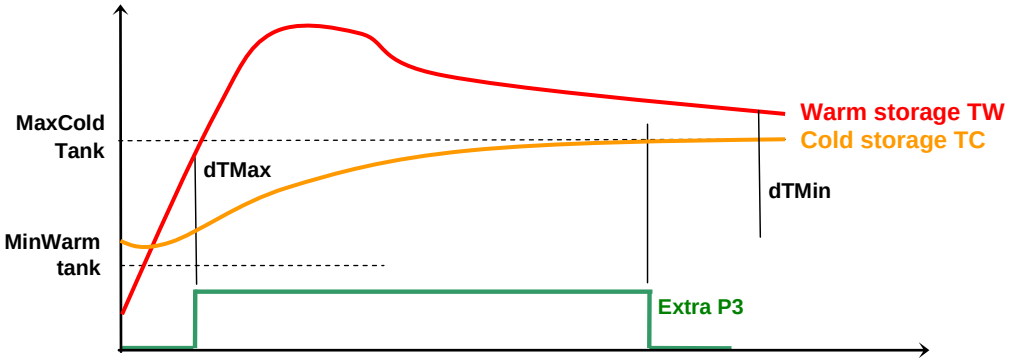
2.13.1 <u>Max cold tank</u>:
When the temperature at the top of the external tank (**T3**) registers above this setting, **P3** will shutoff and the exchange of heat will stop (**T3 = TC**).
(Adjustable from 59°F to 203°F with factory default set at 149°F)

2.13.2 <u>Min warm tank</u>:
The temperature at the top of the system tank (**T4**) must register above this setting before **P3** will engage and the exchange of heat will start (**T4 = TW**).
(Adjustable from 32°F to 203°F° with factory default set at 59°F)

For systems with an additional tank <u>AND</u> an auxiliary heat source (Service / 1.4.3 Example #2)

2.13.3 <u>Max cold tank</u>:
When the temperature at the top of the system tank (**T3**) registers above this setting, **P3** will shutoff and the exchange of heat will stop (**T3 = TC**).
(Adjustable from 59°F to 203°F with factory default set at 149°F)

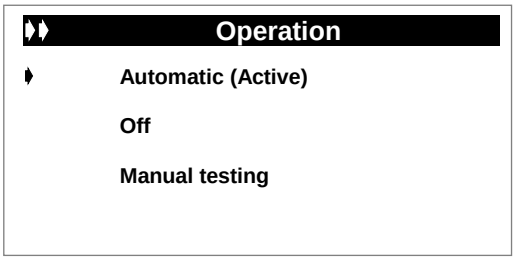
2.13.4 <u>Min warm tank</u>:
The temperature at the top of the external tank (**T4**) must register above this setting before **P3** will engage and the exchange of heat will start (**T4 = TW**).
(Adjustable from 32°F to 203°F° with factory default set at 59°F)



2.13.5 <u>dTMax</u>:
Temperature difference (**ΔT**) between the tank designated as cold storage (**TC**) and the one designated as warm storage (**TW**) at which **P3** will automatically start the exchange.
(Adjustable from 5°F to 72°F with factory default set at 18°F)

2.13.6 <u>dTMin</u>:
Temperature difference (**ΔT**) between **TC** and **TW** at which **P3** will automatically stop the exchange.
(Adjustable from 3°F to 54°F with factory default set at 9°F)

3 Operation Menu:



3.1 Automatic and Off operation:

To operate your system in Automatic mode, highlight the line and press the **(+)** or **(-)** buttons to select **Automatic**
Press **(>)** to activate.

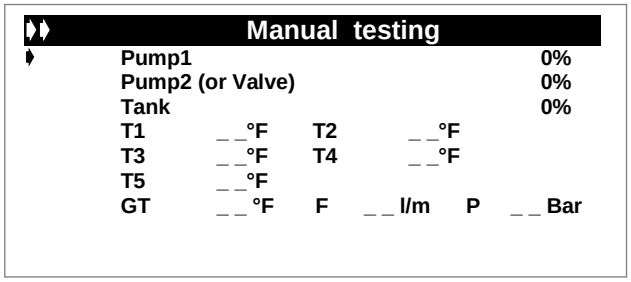
IMPORTANT NOTE: The factory default setting on the **Operation Menu** is **OFF.** This prevents system components (**P1**, **P2**, **P3**) from operating until system is set up. To turn on the system, change the setting to **AUTOMATIC (Active).**

To place your system in **Off** mode, repeat the same sequence detailed above and select **Off**.

3.2 Manual testing operation:

This mode allows you to check the performance of **Pump1**, **Pump2/Valve** and **Extra** outputs. You can also check the data from all sensors (sensors not in use display the maximum value)

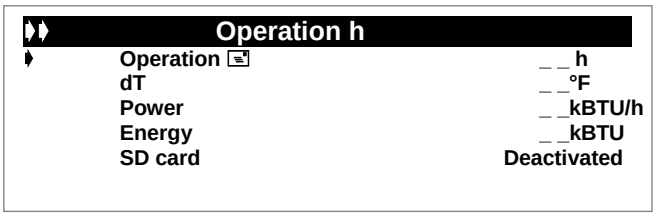
To access this function, select **Manual testing** and press **(>)** to bring up the screen. You can activate different items by using the **(+)** or **(-)** buttons.



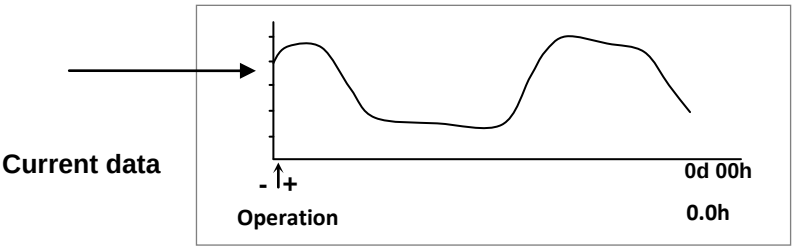
The pump readouts will register no lower than the value set previously on the **Setting** menu (Section 2) under **2.8 Min rev pump.** They can be increased from that level to 100% in 5% increments by using the **(+)** key.

Note: When you exit this menu, all values return to zero.

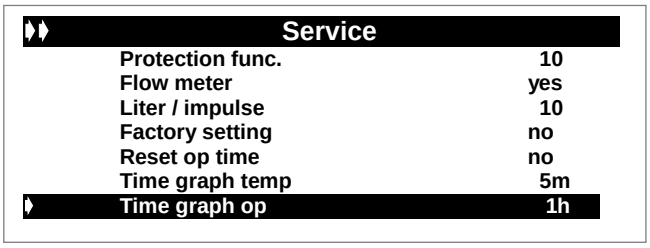
4 Operation h Menu:



This menu offers both a data view and a graph view for the **Operation**, **dT**, **Power** and **Energy** values.



You can change the scale of these graphs on the **Service** menu under **Time graf op**.



Using the **(+)** or **(-)** buttons**,** select **Time graph op** and press **(>)** to highlight the line.

- Now you can change the scale with the **(+)** or **(-)** buttons.

(Adjustable from 1 to 48 hours with factory default set at1 hour)

Press **(<)** repeatedly to return to the main menu.

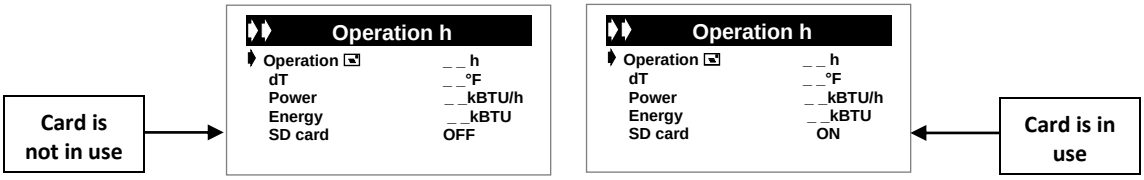
4.1 SD Card Option

You can use the included **SD Card** to store data and transfer system settings from your PC to the Solar Control. The **Dataviewer** software that is installed on the **SD Card** also allows you to view system performance information in graph form. Information on the **SD Card** is limited to either settings that you write to it from your PC or system data that is recorded while the **SD Card** is inserted into the Control (see below).

4.1.1 Initializing the SD Card

It is important to follow these steps as they are listed. Once initialized, the SD Card can be used to set up multiple controls.

1. **Insert the SD Card into the Control**
2. When you click on **(>)** to select the **SD Card** line of the **Operation h** menu, the display will change to **ON.**
3. Click on **(>)** again, changing the display to **OFF**.
4. Press gently on the end of the card & it will pop out for easy removal.
5. **Insert the SD Card into the Control again.**
   - This time, a screen will pop-up and ask if you want to "Update settings from **SD Card**?"
   - Click on "**NO**" – you haven't configured them yet. (There is no way to manually write or save settings from the Control to the **SD Card**.)
6. As before, click on **(>)** to select the **SD Card** line of the **Operation h** menu and change the display to **ON.**
7. Click on **(>)** again, changing the display to **OFF.**
8. Press gently on the end of the card & it will pop out for easy removal.



NOTE: This procedure will only need to be done once per SD Card.

4.1.2 Configuring/Changing your system settings

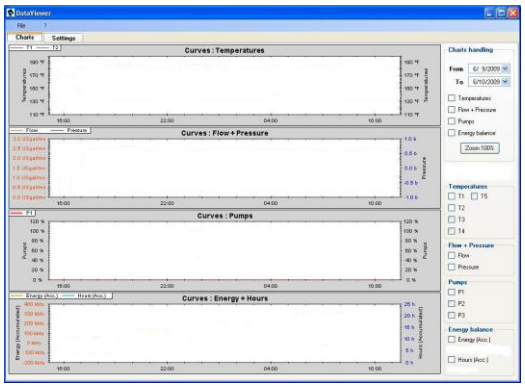
- After initializing and removing the **SD Card** from the **Solar Control**, insert it into the **USB SD Card Reader** (not included).
- Make sure that the SD Card is securely seated in the slot.
  - If the card is not properly seated, your computer will not recognize the Reader.
  - If this occurs, check to make sure that the SD Card is solidly installed – the SD Card will fit into the Reader if it is turned backwards, but it will not fit far enough in to connect to the card reader.
- Insert the **USB SD Card Reader** into an available USB Port on your PC.
- With the **SD Card** inserted into your PC, you can configure all of the Solar Control settings on a single screen.

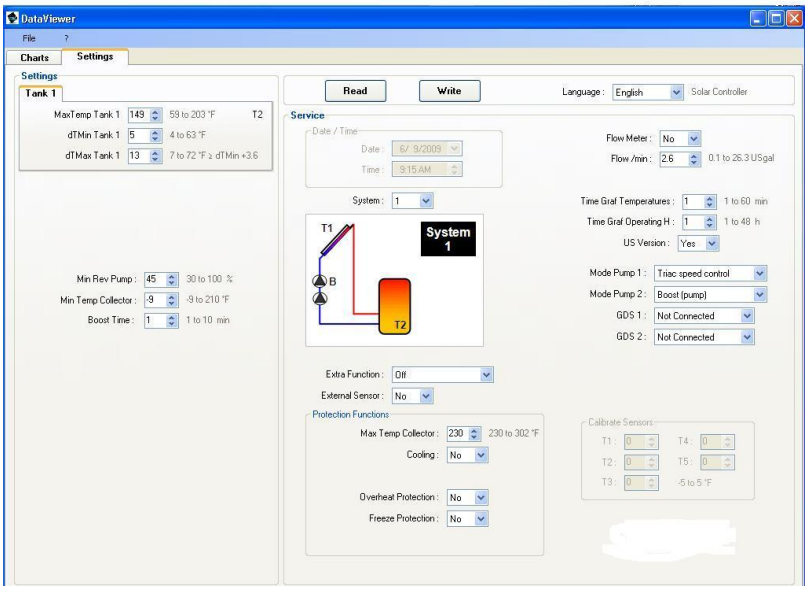
4.1.3 Using the DataViewer software

- When you insert the Reader/Adapter into a USB port on your computer, you will see a screen asking what you want Windows to do. Highlight “Open folder to view the files using Windows Explorer” and click “OK”.

- Double click on 

- The **Charts** tab (first to appear) will be blank until you have left the card installed in the control long enough for system data to accumulate on it.





- Click on the **Settings** tab
- In this window you can view and customize the configuration of your system.
- Click on the “**Write**” button to save your new settings to the **SD Card**.

4.1.4 Transferring Data from the PC to the Control

- Remove the **SD Card** from your PC and insert it (after removing it from the Reader/Adapter) into the slot on the side of the Control.
- When the screen pops-up and asks if you want to “Update settings from **SD Card**?”
  - Click on **(>)**, changing the display to **YES.**
  - This will change the control settings to the configuration you set up on your PC.
- You can now either remove the **SD Card** (after first making sure that it is turned off on the main **Operation h** menu) or turn the **SD Card** on and leave it in the control to gather system performance data as described in the next section.

Do not remove the SD Card without first deactivating it on the Operation h menu.

4.1.5 Viewing Graphs of System Data

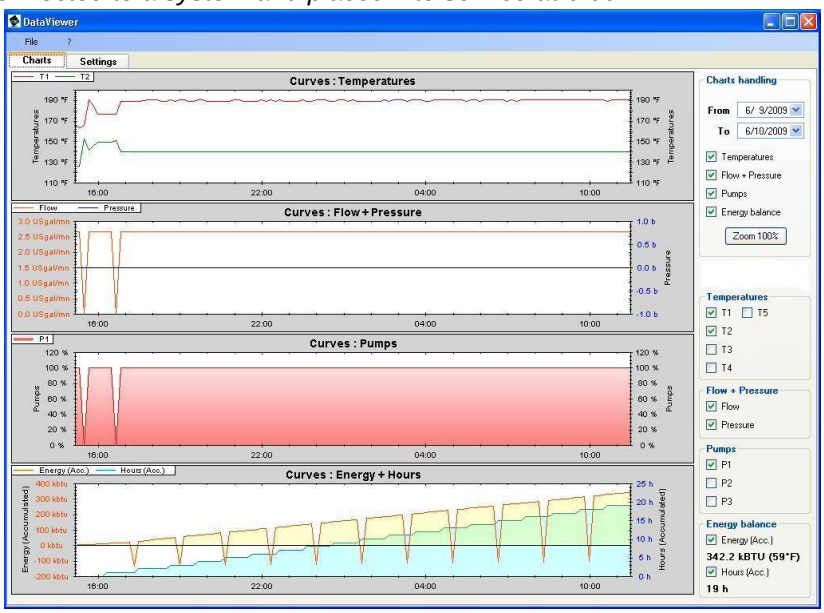
On the Solar Control:

- Graphs that you view on the display screen of the **Solar Control** in the **Operation h** menu are based on all system performance measurements. See page 25 for further information.

With the DataViewer Software:

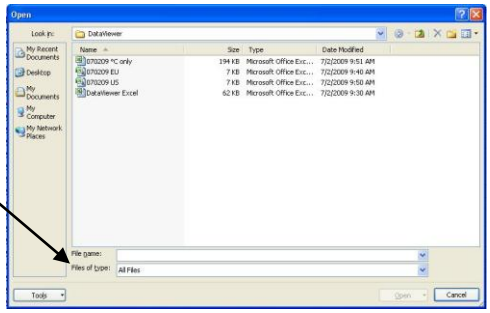
- When the **SD Card** is inserted into the control and switched **ON**, it will automatically record data on system performance as it is recorded by the control.
- When removed from the control and inserted into your PC, this information will be displayed on the **Charts** tab of the **DataViewer** software.
  - It will only graph information gathered while the **SD Card** is inserted in the control and switched **ON**.

For example:
*- A **Solar Control** is connected to a system and placed into service at 6:00 A.M.*
*- An **SD Card** is inserted into the **Solar Control** at 9:00 A.M. and removed at 10:30 A.M. the same day.*
*- The graphs accessible on the **Solar Control** (**Operation h** menu) show system performance information from 6:00 A.M. to whatever time they are viewed.*
*- The graphs displayed on the **Charts** tab of the **DataViewer** software only represent system performance information that registered on the **SD Card** (between 9:00 A.M. and 10:30 A.M.).*



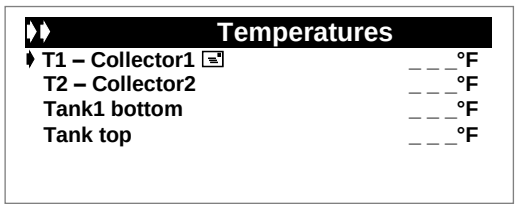
4.1.6 Exporting to Excel

With the **DataViewer** software you have the ability to export the system performance information to **Excel** for further analysis.



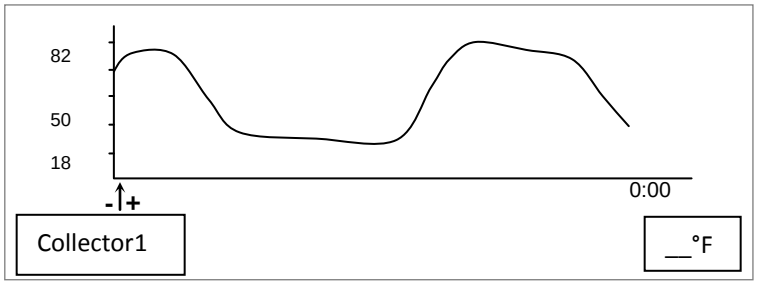
- On the *Files* menu in **DataViewer**, select *Excel Export*. **DataViewer** will export the file (in .csv format) to a location that you select.
- In *Excel*, click *Open* on the *File* menu. (You may have to change the "*Files of type*" to *All Files* to find the exported file.)
- Select Column A in the open file.
- From the *Data* menu, click on *Text to Columns*
- Select *Delimited* (then click Next)
- Select *semicolon* (click Next)
- In the *Column/Data format* you can either leave it as *General*, or select a different format for the entries in each column. Most commonly, Column A would be changed to *Date*.
- Click *Finish*.

5 Temperatures Menu:

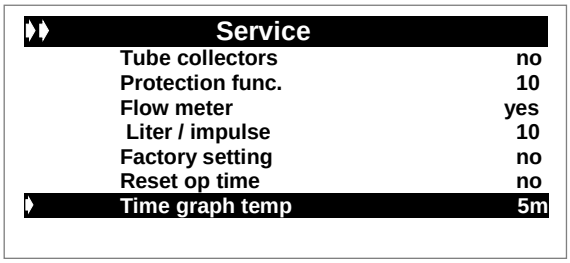


This menu displays the temperatures of all connected sensors except **T5** (see **1.19 Energy Measurement**).

Using the **(+)** or **(-)** buttons you can select a particular sensor and see its time graph by pressing **(>).**



You can change the scale of these graphs on the **Service** menu under **Time graph temp**.



Using the **(+)** or **(-)** buttons**,** select **Time graph temp** and press **(>)** to highlight the line.

- Now you can change the scale with the **(+)** or **(-)** buttons.
  (Adjustable from 1 to 60 minutes with factory default of 5 minutes)

Press **(<)** repeatedly to return to the main menu.

5 Special Functions:

6.1 Pump exercise function:

If pumps are not activated for a period of 48 hours, this function will automatically activate them for 15 seconds to avoid jams.

6.2 Dimmer function:

To save power, the backlight automatically dims if there is no keypad activity for a period of 10 minutes.

6.3 Security function:

To avoid unintentional/unauthorized changes, **System** type and **Extra Function** selection (**No**, **Thermostat**, **Cooling**, or **Diffcontrol**) are inaccessible after the control has been connected to an electrical source for a period of15 minutes.

If you want to modify these parameters at any time past the 15 minute settings lock, you must disconnect and reconnect the power to the controller.

- This action will not reset the control; it will only allow access to make modifications.

To reset all of the control settings to the factory default values, see **Services** / section **1.8 Reset to factory default settings**.

7 Ohm to °F Conversion Chart for PT1000 Sensors:

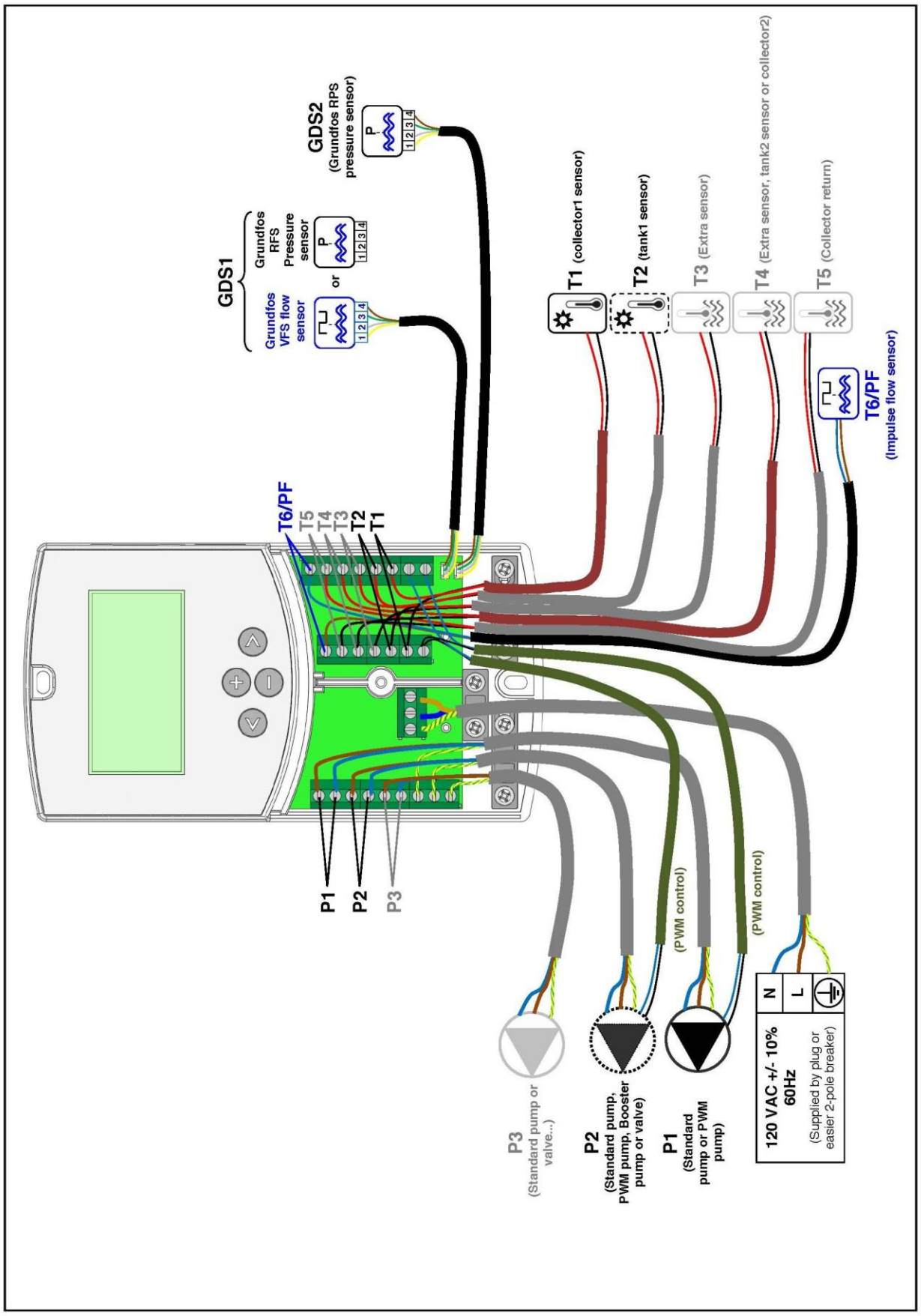
Sensor temperature can be read with an Ohmmeter as a preliminary troubleshooting measure by the following method:

Perform this test only after disconnecting the sensor.

- Disconnect the sensor leads from the solar control.
- Connect the leads to an Ohmmeter.
- Use the following chart to determine the approximate temperature at the sensor bulb.

-14°F (-10°C)	960 ohms	**140°F (60°C)**	1232 ohms
32°F (0°C)	1000 ohms	**158°F (70°C)**	1271 ohms
50°F (10°C)	1039 ohms	**176°F (80°C)**	1309 ohms
68°F (20°C)	1077 ohms	**194°F (90°C)**	1347 ohms
86°F (30°C)	1116 ohms	**212°F (100°C)**	1385 ohms
104°F(40°C)	1155 ohms	**248°F (120°C)**	1461 ohms
122°F(50°C)	1194 ohms	**284°F (140°C)**	1535 ohms

8 Controller Schematic



Limited Warranty

EarthNet Energy warrants this solar control and its associated sensors (the product) to be free from defects in material and workmanship for a period of two (2) years from the date of original purchase. During this period, EarthNet Energy will replace the product or refund the original cost of the product, at EarthNet Energy's option, if the product is proven defective under normal usage within the warranty period.

This limited warranty does not cover shipping costs, nor does it cover a product subjected to misuse or accidental damage. This warranty does not cover the cost of installation, diagnosis, removal or reinstallation, any labor or other material costs, loss of use, or damage to other property if this product does not work properly.

THIS LIMITED WARRANTY IS IN LIEU OF ALL OTHER WARRANTIES AND EARTHNET ENERGY SPECIFICALLY DISCLAIMS ALL OTHER WARRANTIES, EXPRESS OR IMPLIED, INCLUDING THE IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE. The remedies described above are the sole remedies for breach of warranty. In no event shall EarthNet Energy be liable for any special, consequential or incidental damages arising from use or installation of this product.

Appendix VIII

Precise Sizing of the Solar Expansion Tank

Precise Sizing of SolarEXTROL®

Things you must know:

1. Total System Volume . . . . . (1) _____ gallons
2. Minimum System Temperature . . . . . (2) _____ °F
3. Maximum System Temperature . . . . . (3) _____ °F
4. Minimum Operating Pressure at Expansion Tank . . . . (4) _____ psig
5. Maximum Operating Pressure at Expansion Tank. . . . (5) _____ psig

Selection of Expansion Tank:

6. Find and enter "Net Expansion Factor". . . . . (6) _____ (see table 1)
7. Amount of Expanded Water = line (1) x line (6). . . . . (7) _____ gallon
8. Find the "Expansion Multiplier" based on the system's fluid (8) _____ see table 3)
9. Multiply line 7 and 8 . . . . . (9) _____ gallons
10. Find and enter "Acceptance Factor" . . . . . (10) _____ (see table 2)
11. Minimum Total Tank Volume = line (9) ÷ line (10) . . . . . (11) _____ gallons
12. Select an Expansion Tank that is at least equal to line (11) for "Total Volume" and line (9) for Max. Expanded Fluid Acceptance Gallons. Multiple tanks may be required.

Table 1. Net Expansion of Water

Max.Sys. Temp. °F	Minimum System Temperature °F						
	40°F	50°F	60°F	70°F	80°F	90°F	100°F
60°F	.0005	.0049	–	–	–	–	–
70°F	.00149	.00143	.00094	–	–	–	–
80°F	.00260	.00254	.00204	.00111	–	–	–
90°F	.00405	.00399	.00350	.00256	.00145	–	–
100°F	.00575	.00569	.00520	.00426	.00315	.00170	–
110°F	.00771	.00765	.00716	.00622	.00511	.00366	.00196
120°F	.0100	.0099	.0095	.0086	.0074	.0060	.0043
130°F	.0124	.0123	.0118	.0109	.0098	.0083	.0066
140°F	.0150	.0149	.0145	.0135	.0124	.0110	.0093
150°F	.0179	.0178	.0173	.0164	.0153	.0133	.0121
160°F	.0209	.0208	.0204	.0194	.0181	.0165	.0148
170°F	.0242	.0241	.0236	.0227	.0216	.0201	.0184
180°F	.0276	.0275	.0271	.0261	.0250	.0236	.0219
190°F	.0313	.0312	.0307	.0298	.0287	.0272	.0255
200°F	.0351	.0350	.0346	.0336	.0325	.0311	.0294
210°F	.0391	.0390	.0386	.0376	.0365	.0351	.0334
220°F	.0434	.0433	.0428	.0419	.0408	.0393	.0376
230°F	.0476	.0475	.0471	.0461	.0450	.0436	.0419
240°F	.0522	.0521	.0517	.0507	.0496	.0482	.0465

Note: For ethylene glycol and for propylene glycol see Table 3.

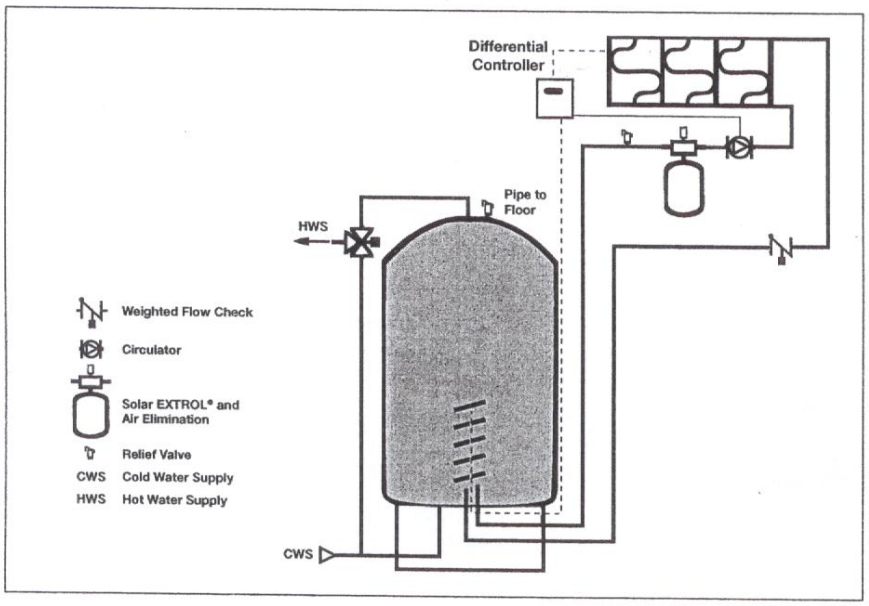
Table 2. Acceptance Factors*

Max.Oper. Pressure at Tank (psig)	Minimum Operating Pressure at Tank (psig)								
	12	15	20	30	40	50	60	70	80
27	0.360	0.288	0.168	–	–	–	–	–	–
30	0.403	0.336	0.224	–	–	–	–	–	–
35	0.463	0.403	0.302	0.101	–	–	–	–	–
40	0.512	0.457	0.366	0.183	–	–	–	–	–
45	0.553	0.503	0.419	0.251	0.084	–	–	–	–
50	0.587	0.541	0.464	0.309	0.155	–	–	–	–
55	0.617	0.574	0.502	0.359	0.215	0.072	–	–	–
60	0.643	0.602	0.536	0.402	0.268	0.134	–	–	–
65	0.665	0.627	0.565	0.439	0.314	0.188	0.062	–	–
70	0.685	0.649	0.590	0.472	0.354	0.236	0.118	–	–
75	0.702	0.669	0.613	0.502	0.390	0.279	0.167	0.056	–
80	0.718	0.686	0.634	0.528	0.422	0.317	0.211	0.106	–
90	0.745	0.716	0.669	0.573	0.478	0.382	0.287	0.191	0.096
100	0.767	0.741	0.698	0.610	0.523	0.436	0.347	0.261	0.174
110	0.786	0.762	0.723	0.642	0.561	0.481	0.401	0.321	0.241

** Acceptance factors based on expansion tank being charged to minimum operating pressure while empty of liquid.*

Table 3. Expansion Multiplier

Water	X 1
30% ethylene	X 1.5
50% ethylene	X 2.0
30% propylene	X 2.0
50% propylene	X 2.5



EARTHNET ENERGY®

MARK OF THE ORIGINATOR

Appendix IX

Warranty Sheet

TWELVE YEAR LIMITED WARRANTY

ENE 16 and ENE 24 Solar Collector

Warranty

EarthNet Energy (ENE) has issued this warranty by Earth Net LLC, 95 Brim Boulevard, Chambersburg, Pennsylvania 17201 and guarantees to the original purchaser the provided manifold and racking manufactured by ENE when purchased for use in residential, commercial or industrial solar hot water heating applications. This warranty applies for twelve years from the date of initial installation that the ENE manifold and racking will be free from defect in materials and workmanship in the manufacturing process under normal use and service when purchased from and properly installed by an Authorized Dealer. During this time, should any ENE manifold and racking malfunction due to a manufacturing defect, the defective manifold and racking will be repaired or replaced, without charge for the equipment by ENE, or its Authorized Dealer or Distributor. Labor expenses to repair or replace will only be reimbursable to an Authorized Dealer during the initial twelve year warranty period. The ENE evacuated solar absorber tubes are warranted completely for six years. After the initial six year warranty from date of purchase, ENE will replace any ENE evacuated solar absorber tube from year six to year twelve at 50% of published retail price excluding labor in the event of a manufacturing defect.

Other Additional Warranties**:** All other warranties provided by manufacturers of components such as tanks, pumps and controllers, etc. which are in excess of one year will be passed along to the customer.

Exclusions

ENE will not be liable for inspection, freight, removal or any other charges arising from this warranty unless stated in this warranty statement. This warranty does not apply to: (1) fluid not approved in advance by ENE for the application; (2) damages resulting from installation or maintenance procedures not approved by ENE; (3) rupture due to pressures exceeding the engineered approved drawings; (4) existing or additional equipment not supplied by ENE; (5) ENE, its dealers, nor its distributors shall be liable for incidental or consequential damages, damages of any sort or nature resulting from abuse, misuse, neglect, abnormal weather conditions, freezing, scaling due to hard water, acts of God, or damage caused by improper installation. This warranty does not apply to installation components not manufactured by ENE or to solar collectors which have not been installed and maintained in strict compliance with ENE's installation and operation instructions and/or applicable ordinances or codes or to systems not installed by an authorized installer or dealer within its authorized territory. In no event shall the liability exceed the purchase price of the product. There are no implied warranties of merchantability or implied warranty of fitness, which extends beyond the description of the twelve year warranty face hereof.

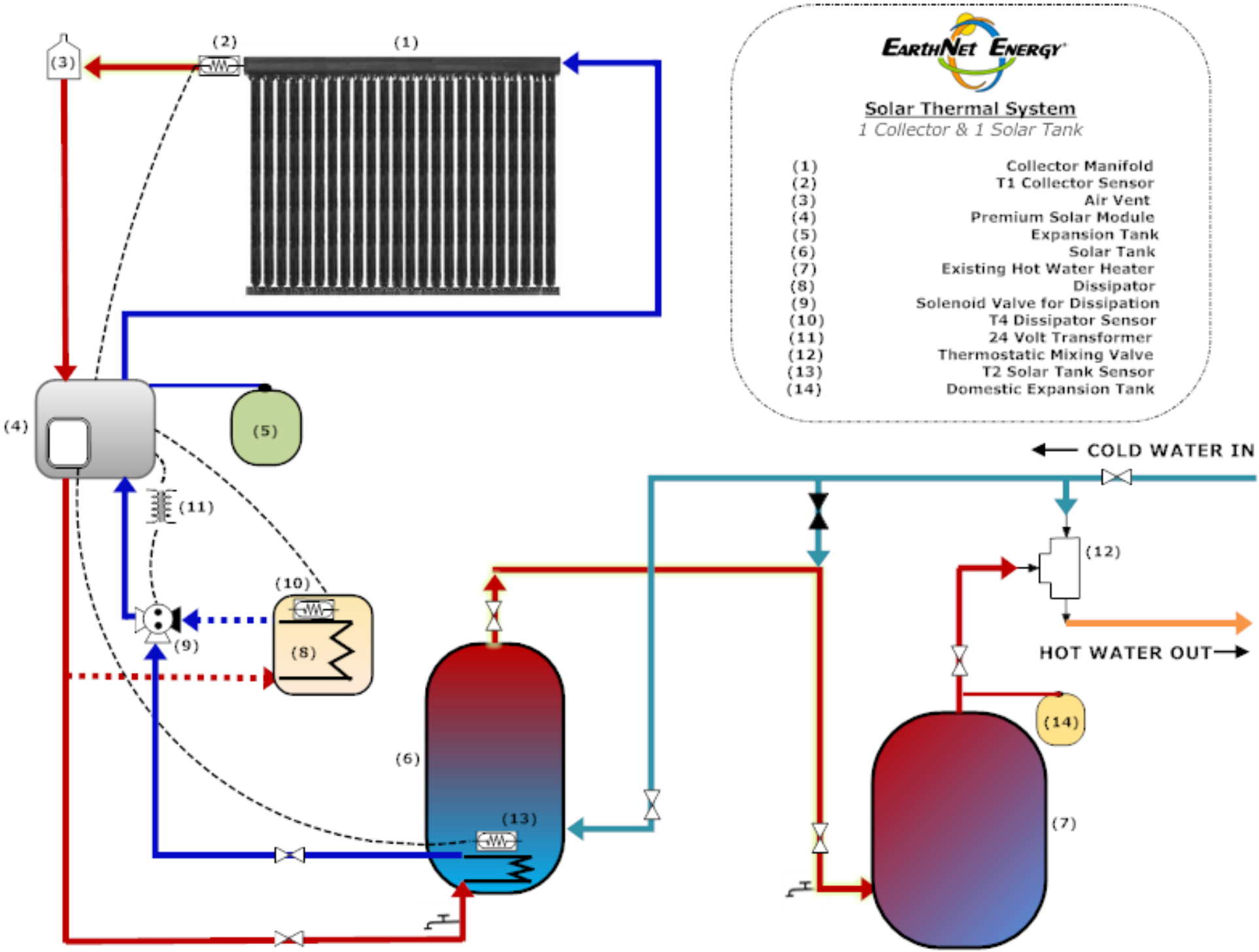
Proof of Purchase

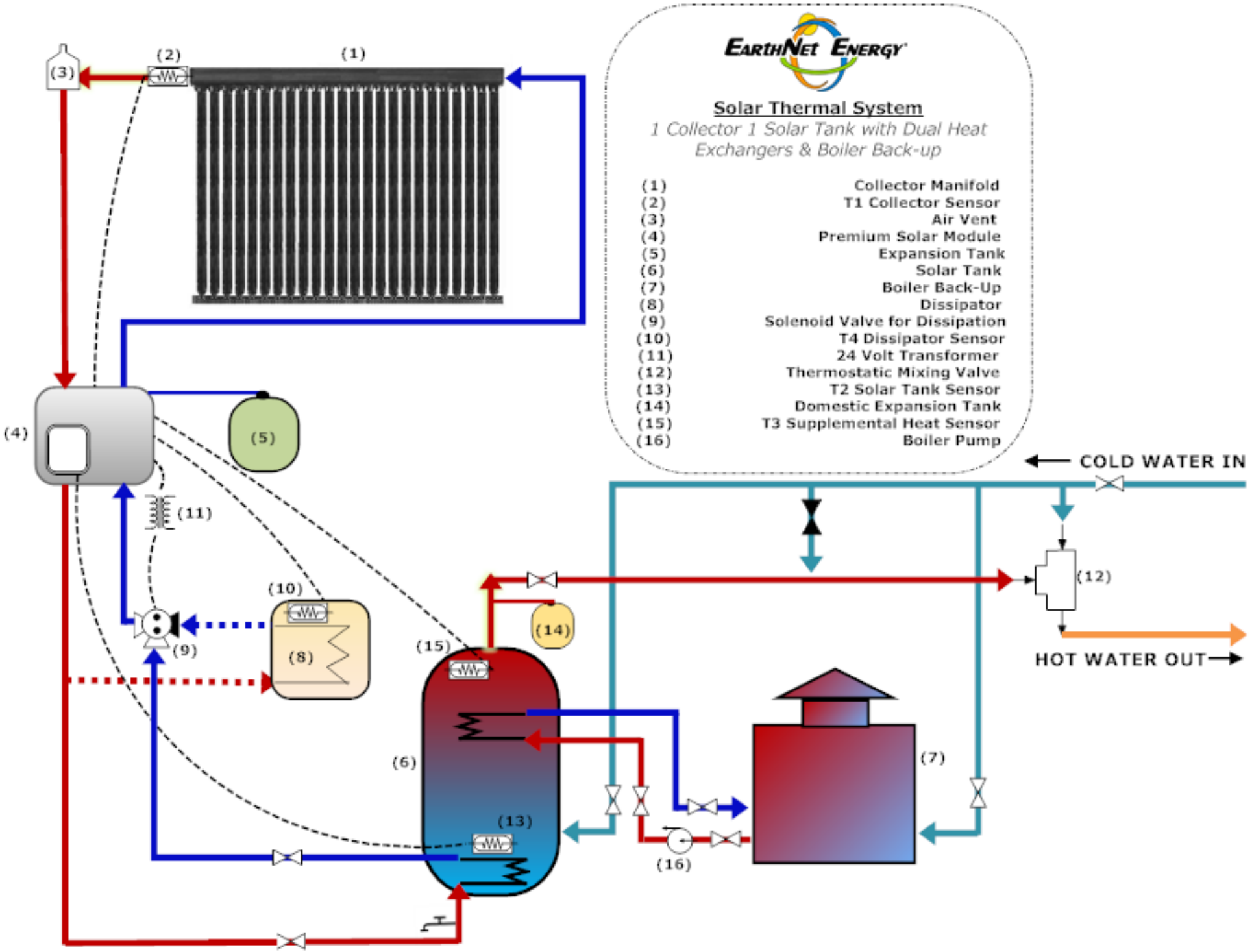
It is the consumer's responsibility to present the original purchase date for warranty purposes. We recommend that a bill of sale, canceled check, or some other payment record be kept for that purpose.

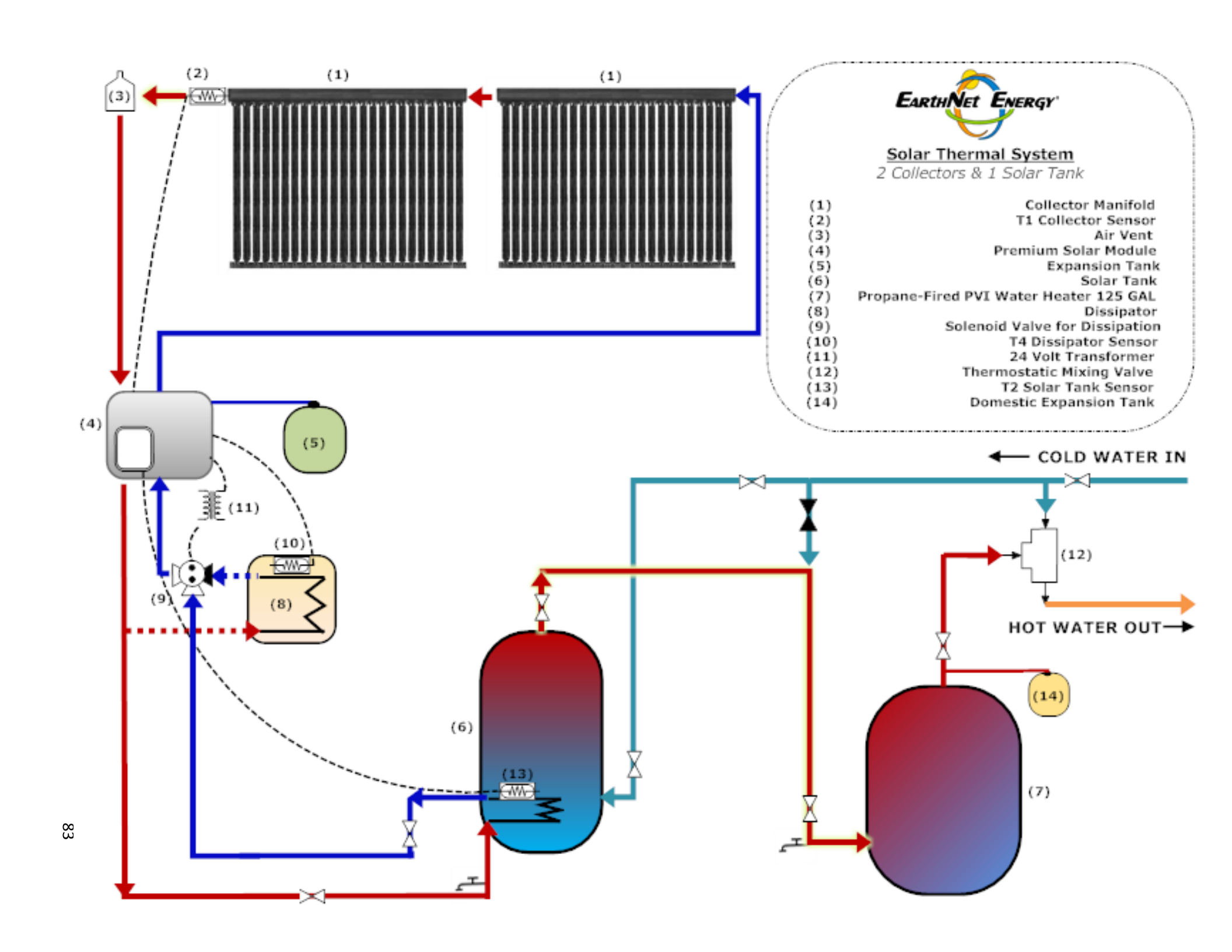
Note: The manufacture reserves the right to make changes or improvements in the design of its collector without assuming any obligation to modify any collector then or previously manufactured. This warranty gives you specific legal rights, and you may also have other rights, which vary from state to state.

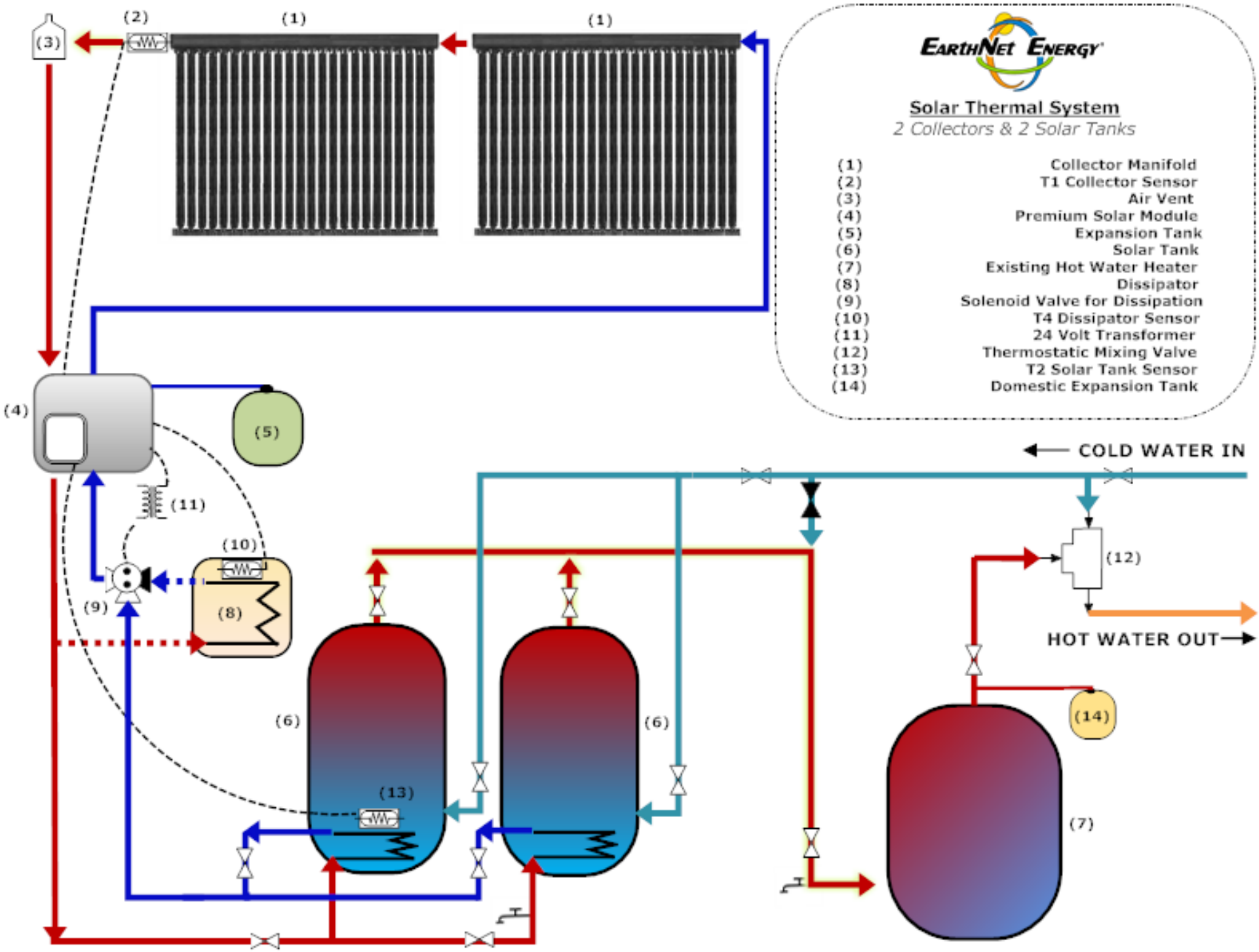
Appendix X

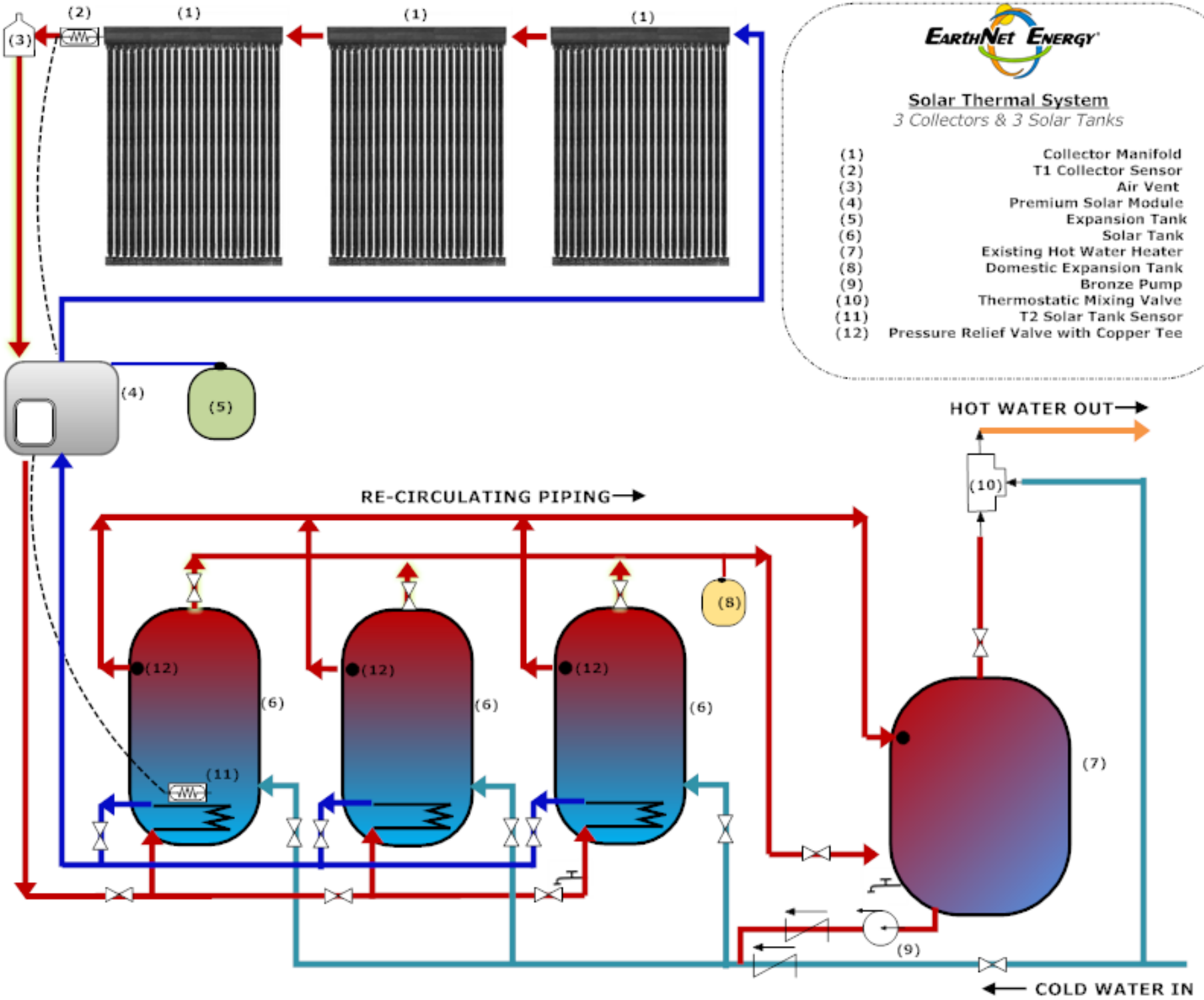
Configuration Schematics

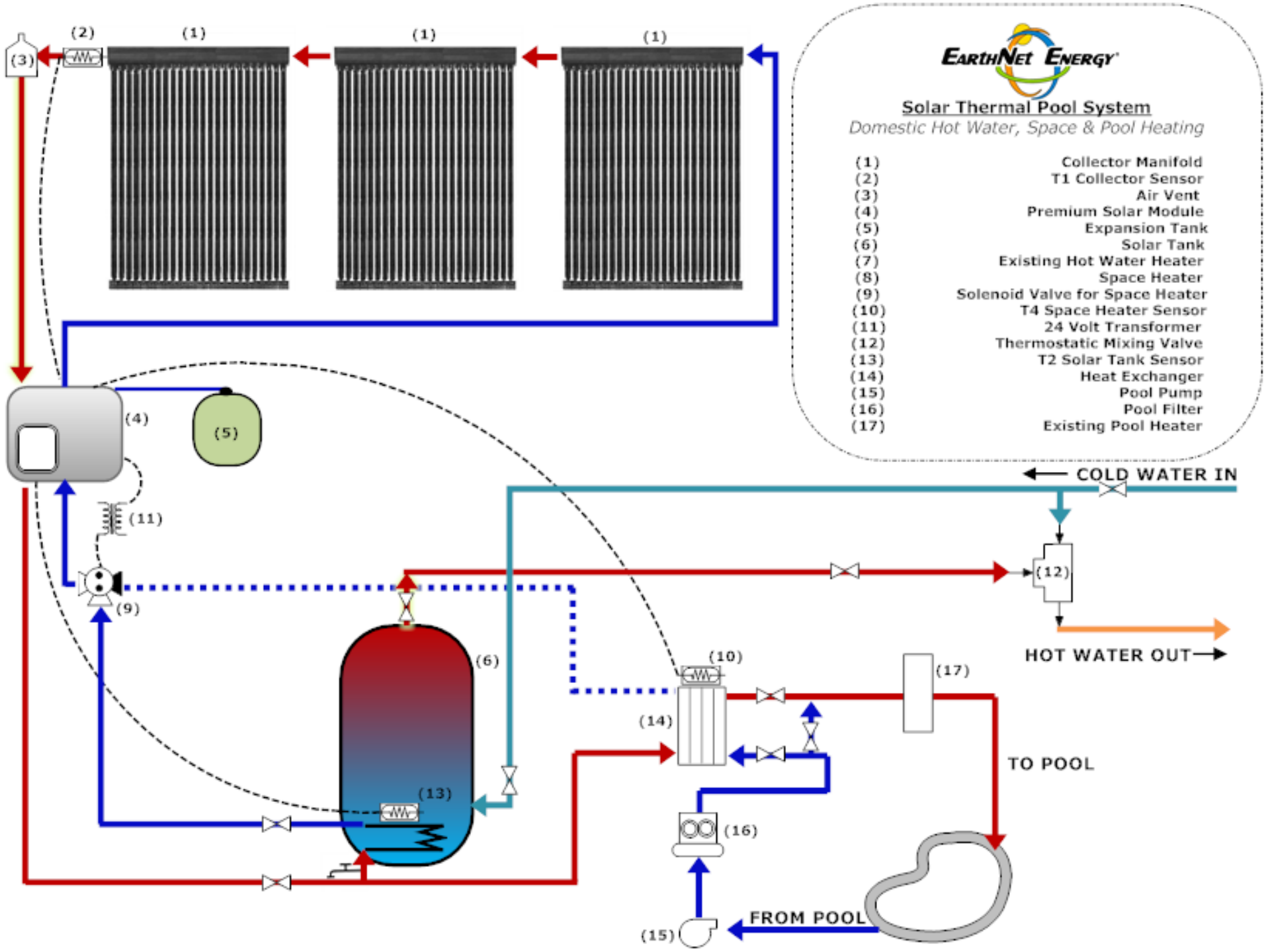

EarthNet Energy
Solar Thermal System
1 Collector & 1 Solar Tank
(1) Collector Manifold
(2) T1 Collector Sensor
(3) Air Vent
(4) Premium Solar Module
(5) Expansion Tank
(6) Solar Tank
(7) Existing Hot Water Heater
(8) Dissipator
(9) Solenoid Valve for Dissipation
(10) T4 Dissipator Sensor
(11) 24 Volt Transformer
(12) Thermostatic Mixing Valve
(13) T2 Solar Tank Sensor
(14) Domestic Expansion Tank
COLD WATER IN
HOT WATER OUT


EarthNet Energy
Solar Thermal System
1 Collector 1 Solar Tank with Dual Heat Exchangers & Boiler Back-up
(1) Collector Manifold
(2) T1 Collector Sensor
(3) Air Vent
(4) Premium Solar Module
(5) Expansion Tank
(6) Solar Tank
(7) Boiler Back-Up
(8) Dissipator
(9) Solenoid Valve for Dissipation
(10) T4 Dissipator Sensor
(11) 24 Volt Transformer
(12) Thermostatic Mixing Valve
(13) T2 Solar Tank Sensor
(14) Domestic Expansion Tank
(15) T3 Supplemental Heat Sensor
(16) Boiler Pump
COLD WATER IN
HOT WATER OUT


EarthNet Energy
Solar Thermal System
2 Collectors & 1 Solar Tank
(1) Collector Manifold
(2) T1 Collector Sensor
(3) Air Vent
(4) Premium Solar Module
(5) Expansion Tank
(6) Solar Tank
(7) Propane-Fired PVI Water Heater 125 GAL
(8) Dissipator
(9) Solenoid Valve for Dissipation
(10) T4 Dissipator Sensor
(11) 24 Volt Transformer
(12) Thermostatic Mixing Valve
(13) T2 Solar Tank Sensor
(14) Domestic Expansion Tank
COLD WATER IN
HOT WATER OUT


EarthNet Energy
Solar Thermal System
2 Collectors & 2 Solar Tanks
(1) Collector Manifold
(2) T1 Collector Sensor
(3) Air Vent
(4) Premium Solar Module
(5) Expansion Tank
(6) Solar Tank
(7) Existing Hot Water Heater
(8) Dissipator
(9) Solenoid Valve for Dissipation
(10) T4 Dissipator Sensor
(11) 24 Volt Transformer
(12) Thermostatic Mixing Valve
(13) T2 Solar Tank Sensor
(14) Domestic Expansion Tank
COLD WATER IN
HOT WATER OUT


EARTHNET ENERGY
Solar Thermal System
3 Collectors & 3 Solar Tanks
(1) Collector Manifold
(2) T1 Collector Sensor
(3) Air Vent
(4) Premium Solar Module
(5) Expansion Tank
(6) Solar Tank
(7) Existing Hot Water Heater
(8) Domestic Expansion Tank
(9) Bronze Pump
(10) Thermostatic Mixing Valve
(11) T2 Solar Tank Sensor
(12) Pressure Relief Valve with Copper Tee
HOT WATER OUT
RE-CIRCULATING PIPING
COLD WATER IN


EarthNet Energy
Solar Thermal Pool System
Domestic Hot Water, Space & Pool Heating
(1) Collector Manifold
(2) T1 Collector Sensor
(3) Air Vent
(4) Premium Solar Module
(5) Expansion Tank
(6) Solar Tank
(7) Existing Hot Water Heater
(8) Space Heater
(9) Solenoid Valve for Space Heater
(10) T4 Space Heater Sensor
(11) 24 Volt Transformer
(12) Thermostatic Mixing Valve
(13) T2 Solar Tank Sensor
(14) Heat Exchanger
(15) Pool Pump
(16) Pool Filter
(17) Existing Pool Heater
COLD WATER IN
HOT WATER OUT
TO POOL
FROM POOL