



SolarRoofs.com, Inc.

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“Skyline³” Open Loop System

Models: 200131C50, 100133C50, 200132C50,

200132C80, 200133C50 and 200133C80

Note: 2, 10-01 collectors may be substituted for 1, 20-01 collector

SRCC OG300 and FSEC Rated Systems

INSTALLATION MANUAL

July, 2009



The solar energy system described by this manual, when properly installed and maintained, meets or exceeds the minimum standards established by the SRCC. This certification does not imply endorsement or warranty of this product by SRCC. “The solar energy system described by this manual, when properly installed and maintained, meets the minimum standards established by the Florida Solar Energy Center, in accordance with Section 377.705, Florida Statutes. This certification does not imply endorsement or warranty of this product by the Florida Solar Energy Center or the state of Florida.” (Note: Skyline is also called Fireball and is used by some dealers)

CONGRATULATIONS!

Thank you! You have just purchased the most attractive and easiest to install active solar water heater made! We have worked on every detail to assure that your “Skyline” water heater will completely satisfy you in its high level of performance and dependability.



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**PLEASE CALL SolarRoofs.com WITH QUESTIONS:
Toll Free USA Technical Install Help Number: (888) 801-9060**

WE WELCOME YOUR COMMENTS! We have endeavored to make the Skyline installation instructions complete and easy to use. We are always looking to make them better and we **welcome** your comments and suggestions!

BEFORE STARTING INSTALLATION

PLEASE CAREFULLY READ THIS ENTIRE MANUAL FIRST!

Remember! A Collector in the Sun Can Be Very Hot – Cover It to Prevent Burns From Hot Copper Tubing and Very Hot Fluid Coming Out of the Tubes

As the collector may have some sharp metal edges and corners, use caution when handling the collector.

This Installation Manual assumes good technical experience and ability.

The Skyline3 can be installed in straightforward situations by two experienced people in less than six hours.

With no experience, the installation will probably take eight to twelve hours, with added complications, like a longer pipe run or two stories, taking longer.

1.0.

Tools and Materials

ITEMS SUPPLIED BY SOLARROOFS.COM:

- Collectors, with Ell brackets, washers, and Tec screws. Gold and Platinum include mounting rails, U brackets, lags.
- Air Vent, Pressure Relief Valve, copper adaptors and compression unions.
- PV Panel. Platinum include mounting brackets and hardware
- Storage Tank isolation ball valves, solar loop drain hose bibs and floating check valve. ‘Quick Connect’ unit including coaxial tank fitting, brass fittings,
- 2 Temperature Gauges with tees.
- 12 Volt Pump, connections and switch.
- 50’ 1/2” outside diameter copper solar loop lines.
- Solar loop installation parts kit including miscellaneous parts, fittings, screws, nuts, bolts, etc.,
- All hardware, two roof boots, 6’ high temp. insulation
- Mixing Valve.
- Installation Manual, Operation and Maintenance Manual and Stickers.
- Optional items such as tilt kit, freeze valve, re-circulation kit with control box.

TOOLS AND MATERIALS NEEDED (to connect to existing water heater):

Overview: Everyday homeowner tools are all that are needed to assemble and install the Skyline solar loop.

Tools and Materials Needed:

- 2 adjustable wrenches and/or wrench set for compression unions.
- Min 18” “Monkey Wrench (best to have 2) for tank water fittings.
- Teflon tape (1/2" wide to seal threaded fittings use 6 turns).
- Quality Pipe Sealant (to seal face of brass union ends).
- Ladder(s) (for roof and for access to attic as needed).
- Tape measure, marking pencil, crayon or chalk (to mark rafters and holes on roof), chalk line.
- 1 1/2" inch wood bit for roof penetrations (for feed and return lines through roof) or 5/8” tile drill bit.
- 7/16" socket with ratchet and 6" extension. (a powerful drill with adapter is desirable for quickly driving lags).
- 1/4” nut driver on high speed drill (to drive 1/4" self tapping screws into collector).
- Caulking gun with quality Polyurethane or Silicone roofing caulk (to fill lag holes and seal flashing to prevent leaks).
- 1/2” or 3/4” wall, 7/8’ ID (for domestic lines and brass solar fittings) and 5/8” ID high temperature open cell pipe insulation for solar loop piping.

The following SRCC, OG300 Rated Systems and Components are Covered in this Manual

System 3 and Option List

Packaging and Delivery to Continental 48 States,

2 and 3 collector systems are shipped assembled in a crate by motor freight.

Standard Color for all systems Musket Brown or Dove Gray. See Options for Architectural Colors.

Skyline System 3 with PV Powered Circulator.

- Skyline 10-01 or 20-01 Collector(s), Split Kit, Single Piece or Parallel Flow,
- Includes 3 mounting rails and 6 Ell brackets with 3 U brackets per additional collector.
- Solar Feed and Return line compression union and Ell couplers.
- Air Vent, Pressure Relief Valve with Splash Pad.
- Very Light Freeze (VF01) Option: Thermal Freeze Valve.
- PV Panel with switch.
- Light Freeze* (FS03) Option: Recirculation freeze snap switch, 12 volt transformer.
- Storage Tank 'Quick Connect' unit including Isolation Ball Valves, Solar Loop Drain Hose Bibs and Check Valve.
- 12 Volt Electronic Pump and connections.
- 50' 1/2" outside diameter copper solar loop lines.
- Solar loop installation parts kit including miscellaneous parts, fittings, screws, nuts, bolts, etc.,
- All hardware, two roof boots, 6' high temp. 1/2" wall high temperature insulation.
- 2 Thermometers, domestic hot water mixing valve.
- Installation Manual, Operation and Maintenance Manual (O & M manual) Quick Look Operation Guide Tag.

20 s/f Collector System, Model Number: 200131C50, use minimum 50 gallon electric tank with bottom element disconnected from upper element or is connected to a gas or electric tank.

30 s/f Collector System, Model Number: 100133C50, use minimum 50 gallon electric tank with bottom element disconnected from upper element or is connected to a gas or electric tank.

40 s/f Collector System, Model Number: 200132C50, and 80, use 50 or 80 gallon electric tank with bottom element disconnected from upper element or is connected to a gas or electric tank.

60 s/f Collector System, Model Number: 200133C50 and 80, use 50 or 80 gallon electric tank with bottom element disconnected from upper element or is connected to a gas or electric tank.

***"Light Freeze" Recirculation freeze protection option** is recommended for mild weather climates and where the temperature occasionally dips below freezing. Recirculation can provide a higher level of freeze protection in light freeze areas. A Thermal Freeze Valve on 4" stub is always included with the "LF" option.

Freeze Protection Options:

NF = No Freeze Zone - Tropical, (no freeze protection at all)

VF = Very Light Freeze Zone - Sub Tropical (45F Dole)

LF = Light Freeze Zone - Temperate (Recirculation and or 45F Dole)

Tilt Kit (option) Tilts collectors approximately 18 degrees from existing roof angle, Other angles available on request. Tilt kits are used when a better winter angle is desired on a low pitch roof or to "re-orientate" panels to face south by running the panels up and down an East or West facing roof. See Special Instructions.

Single Panel: Collector kit with 3 or 4 Modified 24" rails with 6" legs and hardware: (Option Code /#TK01)

Double panels: Collector kit 3 or 4 - 4' 1" x 1" Aluminum Rails with 12" legs and hardware: (Option Code /#TK02)

Triple panels: Collector kit 3 or 4 - 6' 1" x 2" Alum. Rails with 24" legs and hardware: (Option Code /#TK03)

Standard Color (Default): Musket Brown (C101)

Free Optional Color: Dove/Old Town (Medium) Gray (C109) - Note: This is a no cost option.

Optional Colors Include:

Colonial (light) Gray (C102), Tahoe Blue (C103), Colonial Red (C104), Forest Green (C105), White (C106), Buckskin Brown (C107), Beaver (medium) Brown (C108), C.B. (medium) Blue (C110), Spanish Green (C111), Storm/Slate (dark) Gray (C112), Royal Brown (C113), Ivory (C114), Sea Blue (C115), Leaf Green (C116), Pebblestone Clay (C117), Woodbeige (C118), Peach (great on many light orange tile roofs) (C119), Almond (C120), Black (C121), Adobe Tan (C121), Classic Cream (C122), Bronze (C123), Heritage Cream (C124), Marine Green (C125).

Components (for individual purchase):

MV01, Mixing Valve:

QF34, Quad Flow Diverter

TR50, 50 foot roll of 3/8" ID, 1/2" OD soft copper tubing with 2 compression unions

ES10, El Sid 10 Watt 12V Circulator

HC18, March 809 18 Watt 12V Circulator

PV10, 10 - 11 Watt 12V Panel With Mounting Hardware

PV20, 20 – 21 Watt 12V Panel With Mounting Hardware

PV20, 30 - 32 Watt 12V Panel With Mounting Hardware

PR15, 150 Pound Pressure Relief Valve

CV01, Floating Ball Check Valve

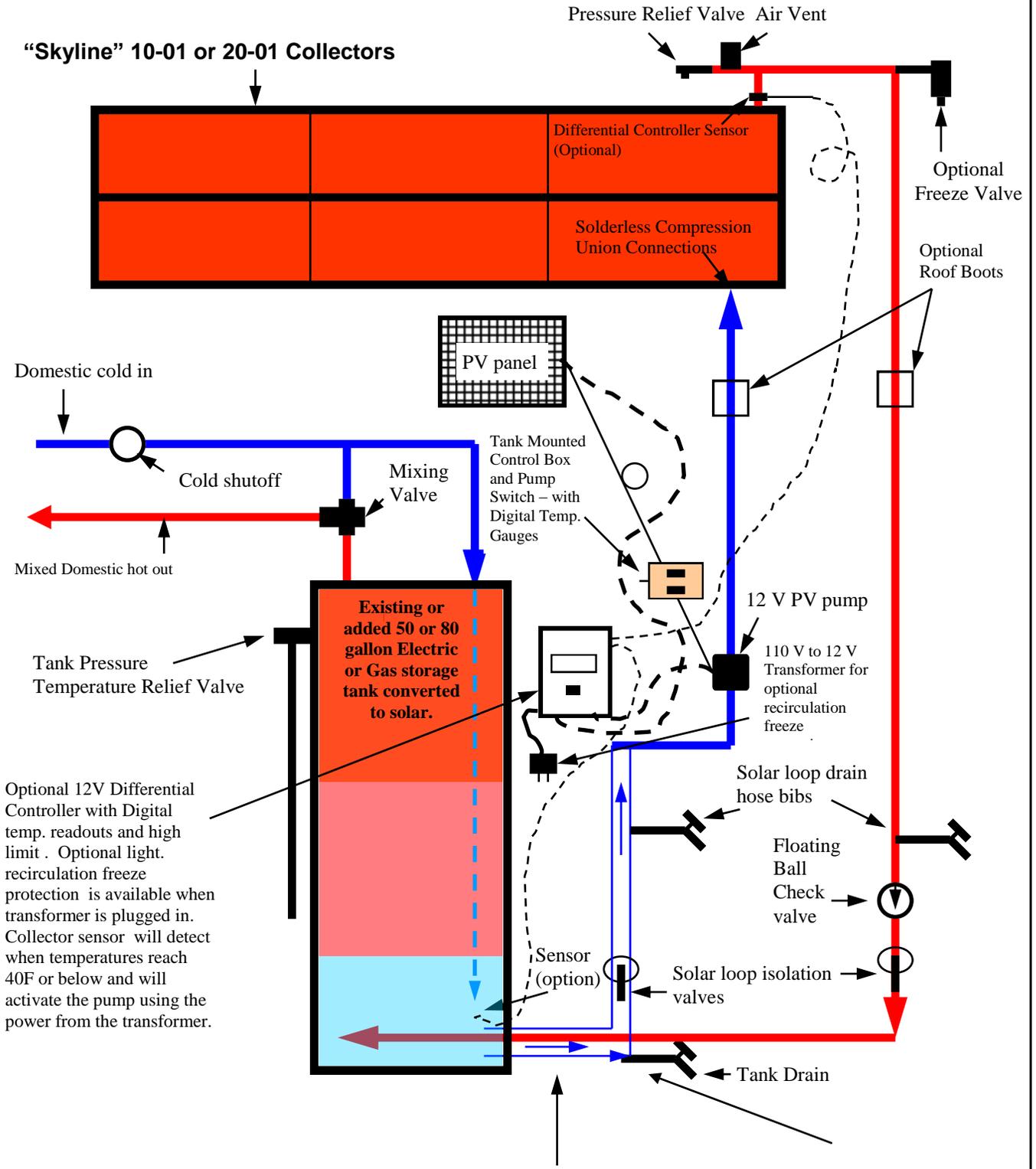
H180, 180 F High Temperature snap switch, open 180 F, close 140 F, place on cold in



4, 10-01 Collector, 40 s/f System, 100134C50 or 80 shown above in Side by Side (2x2) configuration

Skyline3 with bottom "Quick Connect"

"Skyline" 10-01 or 20-01 Collectors



Domestic cold in

Cold shutoff

Mixed Domestic hot out

Existing or added 50 or 80 gallon Electric or Gas storage tank converted to solar.

Tank Pressure Temperature Relief Valve

Optional 12V Differential Controller with Digital temp. readouts and high limit. Optional light. recirculation freeze protection is available when transformer is plugged in. Collector sensor will detect when temperatures reach 40F or below and will activate the pump using the power from the transformer.

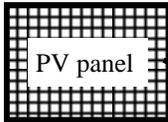
Pressure Relief Valve Air Vent

Differential Controller Sensor (Optional)

Solderless Compression Union Connections

Optional Freeze Valve

Optional Roof Boots



Tank Mounted Control Box and Pump Switch - with Digital Temp. Gauges

12 V PV pump

110 V to 12 V Transformer for optional recirculation freeze

Solar loop drain hose bibs

Floating Ball Check valve

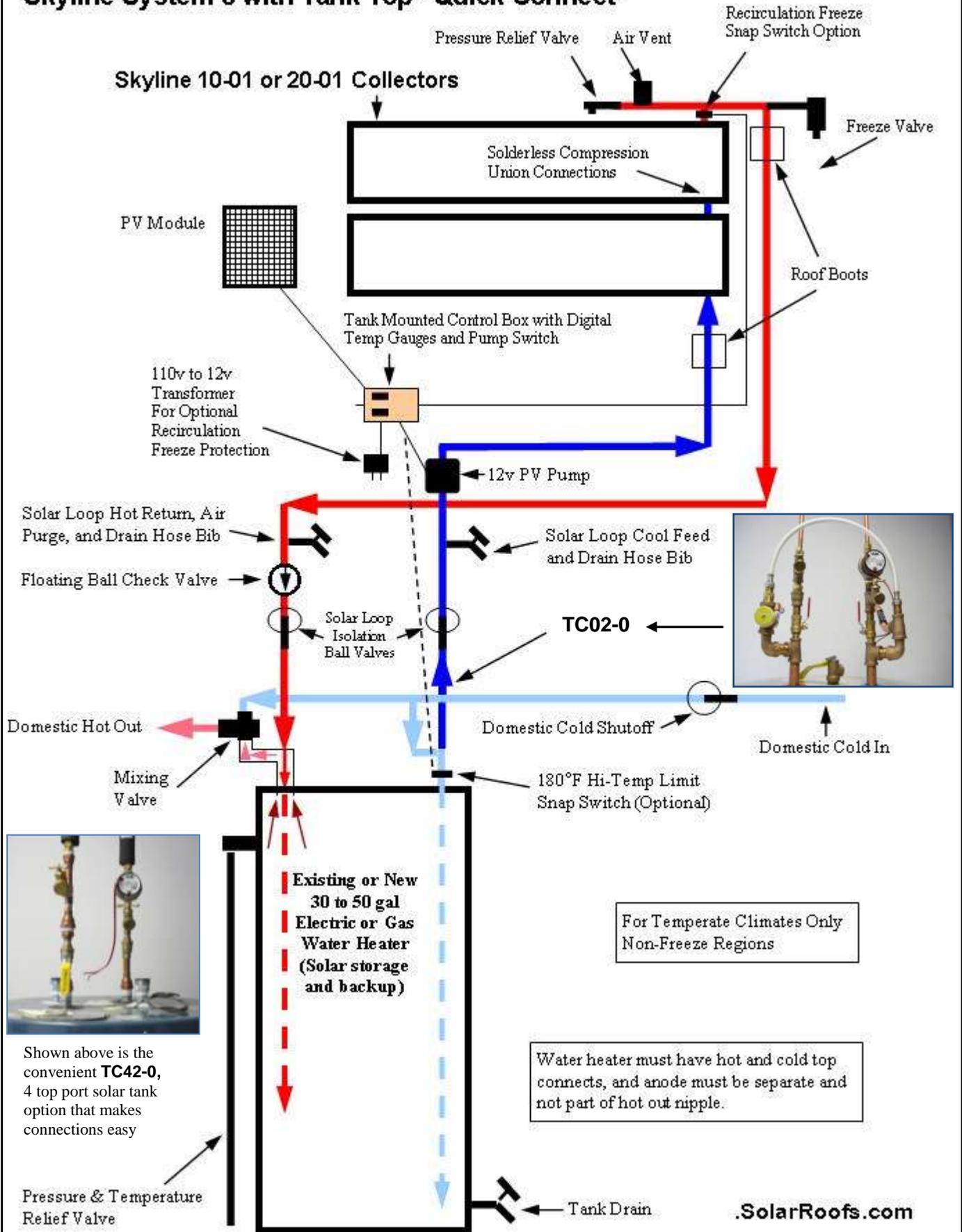
Sensor (option)

Solar loop isolation valves

Tank Drain

SolarRoofs Tank Bottom "Quick Connect" Coaxial Connection

Skyline System 3 with Tank Top "Quick Connect"

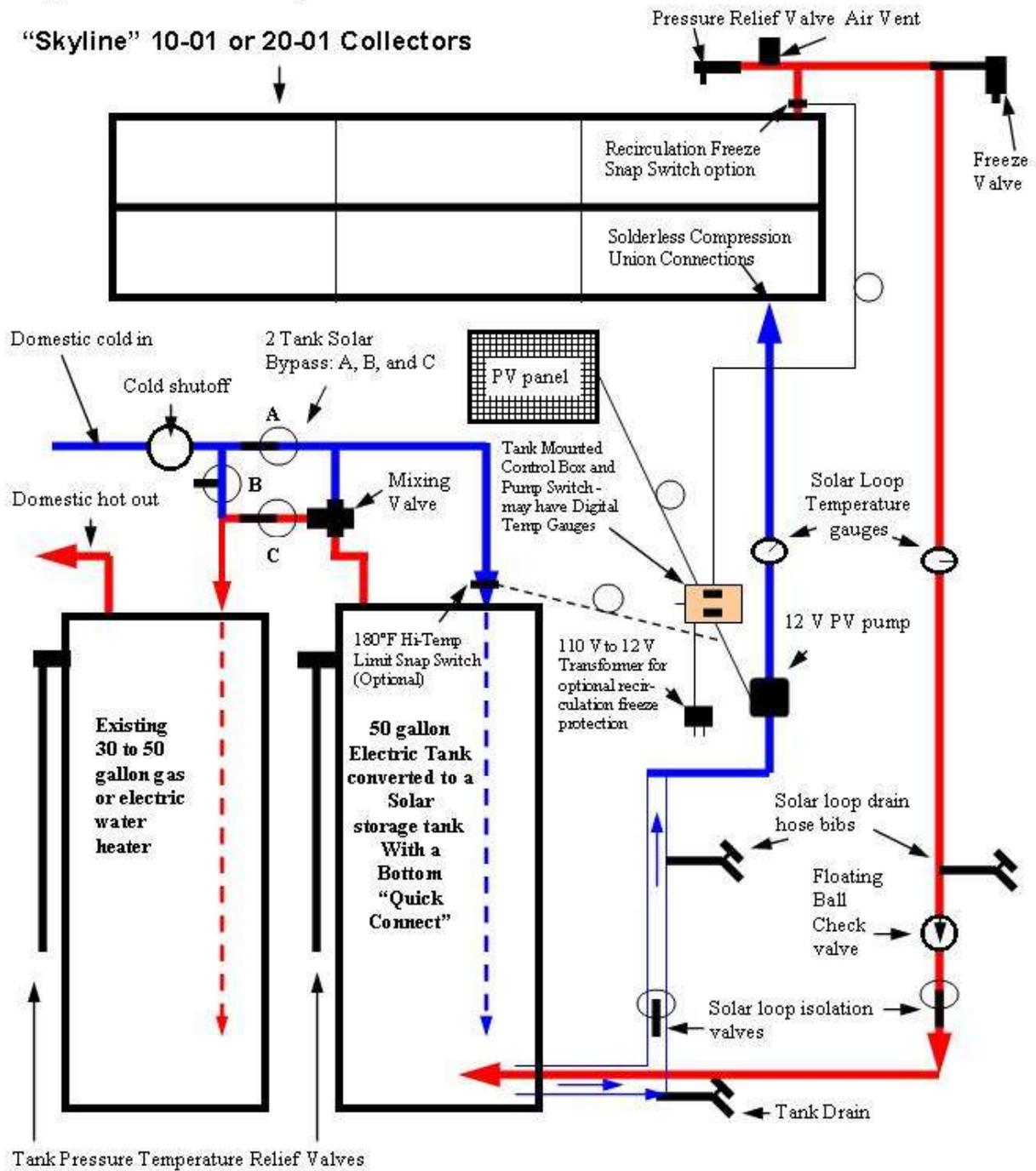


Shown above is the convenient TC42-0, 4 top port solar tank option that makes connections easy



“Skyline” Two Tank System 3 Models: 200132C502TG and 200132C502TE

“Skyline” 10-01 or 20-01 Collectors



SRCC Required Solar Bypass Valves

Normal Solar Operation: A, and C are Open and B is Closed

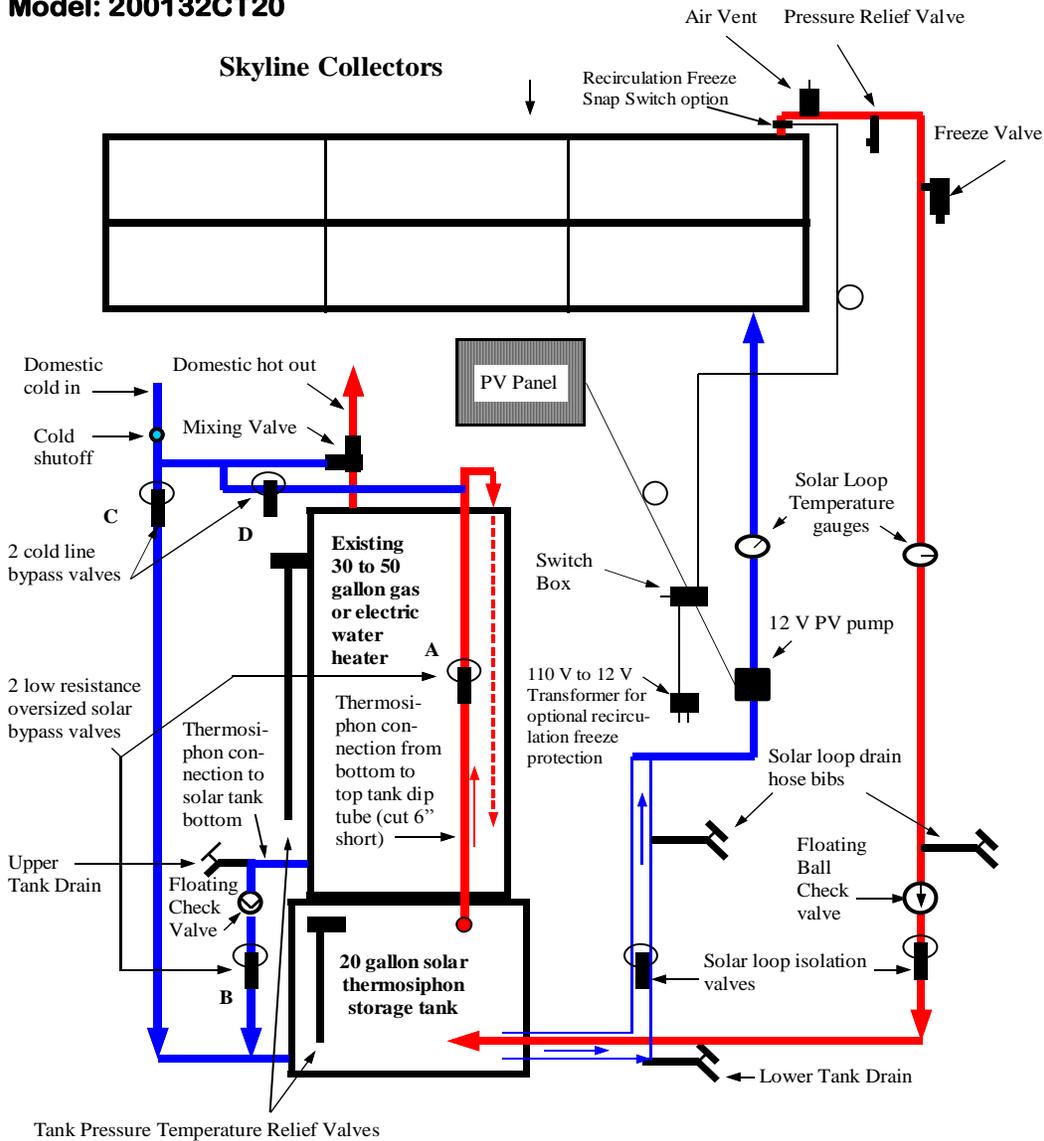
Solar Tank bypass: A, and C are Closed and B is Open

Tank Under "Skyline" System 3 "T20"

20 gallon storage tank with thermosyphon loop to heat upper gas or electric tank Model Number: 200132CT20.

Note: Specific T20 installation instructions are not included in this manual as it is usually a dealer installed system. The following diagram and picture is supplied to show where to connect the lines to those wishing to install it themselves.

Model: 200132CT20



SRCC Required Solar Bypass Valves

Normal Solar Operation: A, B and C are Open and D is Closed

Solar Tank bypass: A, B and C are Closed and D is Open

Note: When a single electric tank is used, the lower element is to be disconnected from the upper element to meet SRCC guidelines. The Upper tank dip tube needs to be cut 8" to facilitate thermosyphoning.

“Skyline3” Solar Water Heater Specifications

COLLECTOR (Panel)

Trim & Frame Materials:	Finished 27 mil Aluminum Trim and Frame = Total 54 mil (1.37 mm).
Insulation:	Bottom: 1" (2.54 cm) Foil Faced Celotex or Equal
Absorber Material:	“Crystal Clear” selective coated - all Copper with compression unions.
Glazing:	.236" (6.0 mm) Twinwall Polycarbonate UV Treated
Dimension / Weight:	10-01 - 72" x 20" x 3"; 19 lbs 20-01-144.3"x 20."x 3" 38 lb
Fluid Capacity:	10-01 = .15 Gallons, 20-01 = .3 Gallons
Recommended Flow Rates:	.20 to .35 GPM (0.946 to 1.324 L/min)
Maximum Working Pressure:	150 PSI (10.21 atm).
Maximum Stagnation Temp:	250 °F (121.11 °C).
Heat Transfer Fluid:	Potable water
Standard Components:	3 Mounting rails, mounting brackets, tech screws and lags
Color:	Musket Brown (C101 – default color) or Dove/Old Town Gray (C109) + optional colors

PV (Photovoltaic) POWERED CIRCULATOR

PV Panel:	10 - 15 or 20 - 2 Watt, 12volt DC with switch or optional Differential Control.
Circulator:	12 Volt - Laing D5 Solar”

FREEZE PROTECTION

Type:	Freeze Valve - Passive Freeze Valve for light freeze protection down to 30F
Temperature to open:	Very light freeze (VF & LF) 40 °F - Starts to open and drip water at 40° F.
Type:	Light Freeze (LF) Recirculation with 40F Freeze Snap Switch for 12 Volt Circulator using 12 volt Transformer for light freeze protection down to 20F for up to 8 hours, includes switch box with diodes to prevent backflow, NOTE: any freeze damage is not covered by Warranty.
Type:	Solar Loop quick shut off ball valve set.

CONNECTING LINES, INSULATION (standard)

Tubing:	1/2" (12.7 mm) OD copper - 50' (15.24 m)
Insulation, High Temperature (6' (1.83 m) supplied):	1/2" (12.7 mm), 1/2" (13 mm) wall

TUBING CONNECTION METHODS (standard)

Type:	Brass Union, Compression.
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STORAGE TANK (Not Supplied)

Standard Connections:	Use Existing 50 gallon minimum (189.27 L) tank for 1, 2 or 3 Collectors or 80 gallon (303 L) tank for 2 or 3 Collectors.
	Max. Temperature tank must withstand: 190 °F (87.77 °C)
	Max. Pressure tank must withstand: 150 psi (10.21 atm)

Note: When a single electric tank is used, the lower element is to be disconnected from the upper element to meet SRCC guidelines.

CONTROL

Type:	12 Volt PV Panel with switch which automatically regulates circulator operation.
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Although we will make every effort to give notice, Specifications and prices subject to change without notice.

“Skyline” Open Loop System 3



Top: 2, 20-01 Stacked Collectors



Top Right: 4, 10-01 Stacked Collectors
(20-01 would be the same but with 3 rails)



Right: 4, 10-01 Side by Side Collectors
(20-01 would be the same but with 6 rails)



Far Right: Storage Tank “Easy Connect “

Components Included with the Skyline3 Silver:



Silver Skyline3 system includes:

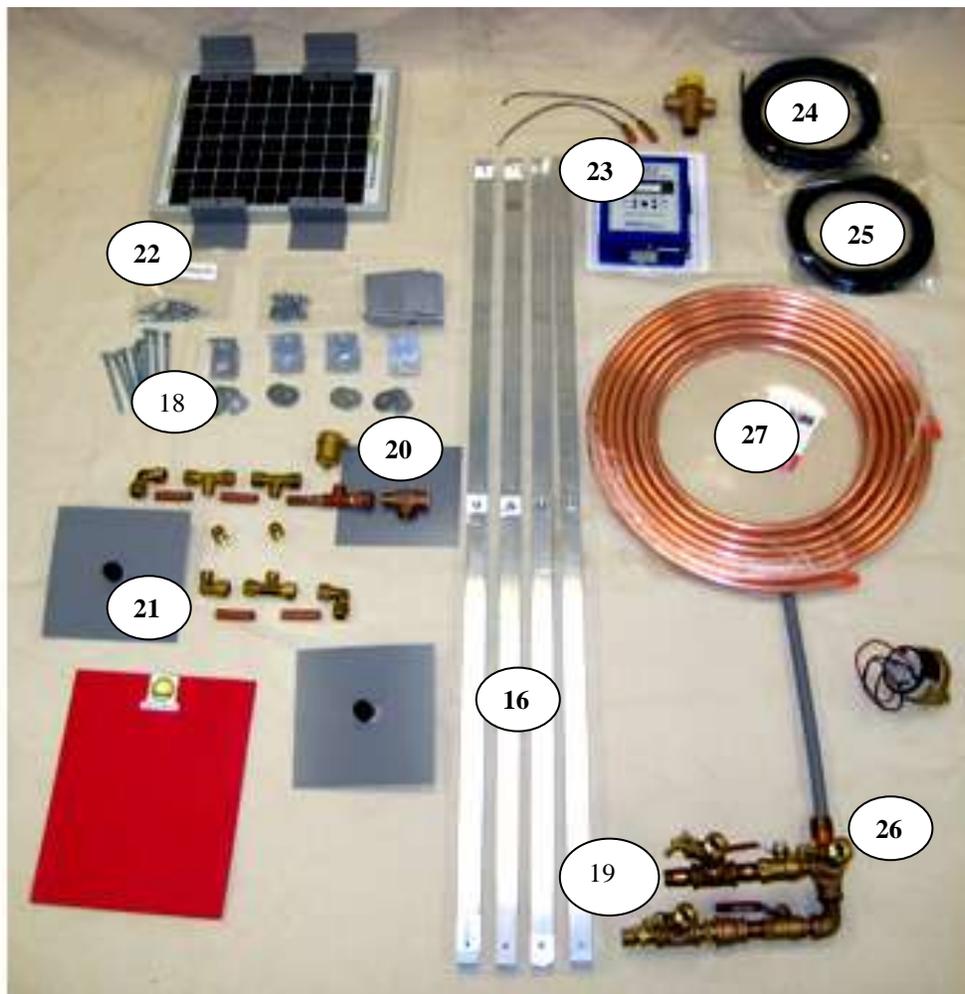
1. 2 to 6 Skyline 10-01 collector (s) with all copper, "Crystal Clear" coated high performance absorber. 4 Ell mounting brackets, 4 washers and 8 tec screws are included per collector. Choice of Musket (dark) brown or Dove (medium) gray trim colors.
2. High quality 12 Volt "PV" solar electric panel matched to the power need of the system.
3. Sophisticated 12 Volt Laing D5 Electronic Circulator.
4. Twin digital thermometer box with on / off switch.
5. 1, 1/2" male Adjustable Pressure Relief Valve (set to 150lb) with roof splash guard.
6. Air Vent with adaptor to 1/2"
7. 2 Hose bibs with 1/2" male thread
8. 2 Ball valves with 1/2" sweat fittings
9. 2, 1/2" compression unions plus one union body per additional stacked collector.
10. 4, 1/2" x 3/8" copper reducing adaptors
11. 2' of 3/8" copper tubing
12. Tempering Valve
13. Exclusive, zero resistance floating ball check valve with 1/2" male pipe thread fittings.
14. Installation Manual, Operations and Maintenance Manual, Special SRCC OG-300 Labels

Gold Skyline3 Option (HIGHLY RECOMMENDED) Includes:

The Gold Skyline3 system Includes 1. – 14 above plus 15 - 27:

Note: Items 4, 10 and 13 are substituted with upgrades. The collector mounting system is upgraded as well.

15. Choice of either 10-01 or 20-01 collectors (not shown).
16. Exclusive predrilled and assembled collector rail mount system with color coded "U" Brackets.
17. Choice of "Stacked" or "Side by Side" collector layouts – see configurations.
18. Roof mounting lag set or special mounting as needed for composition or tile roof.
19. Exclusive, 100% complete no-solder solar loop with all fittings.
20. Pre-soldered collector assembly for air vent and pressure relief valve.
21. 2, color coded roof boots.
22. PV Panel Mounting Kit.
23. Sophisticated 12 Volt Digital Readout Differential Controller with high temperature limit and 2 sensors- replaces box
24. 25' of #18-3 PV wire with wire nuts.
25. 30' of sensor wire with wire nuts.
26. Exclusive bottom "Quick Connect" that replaces the drain at the bottom of the tank with an easy to install "coaxial" fitting. This fitting allows the solar collector's feed and return line to share the same hole. Returning solar heated water goes through a center tube into the tank. The warmer solar heated water immediately rises and at the same time cool water is being pulled by the solar pump through the space around the hot return tube. Use top connect when space is limited in front of the tank, or in areas with a lot of sediment. Top Connect is available at additional cost.
27. 50' of ½" OD soft copper tubing.

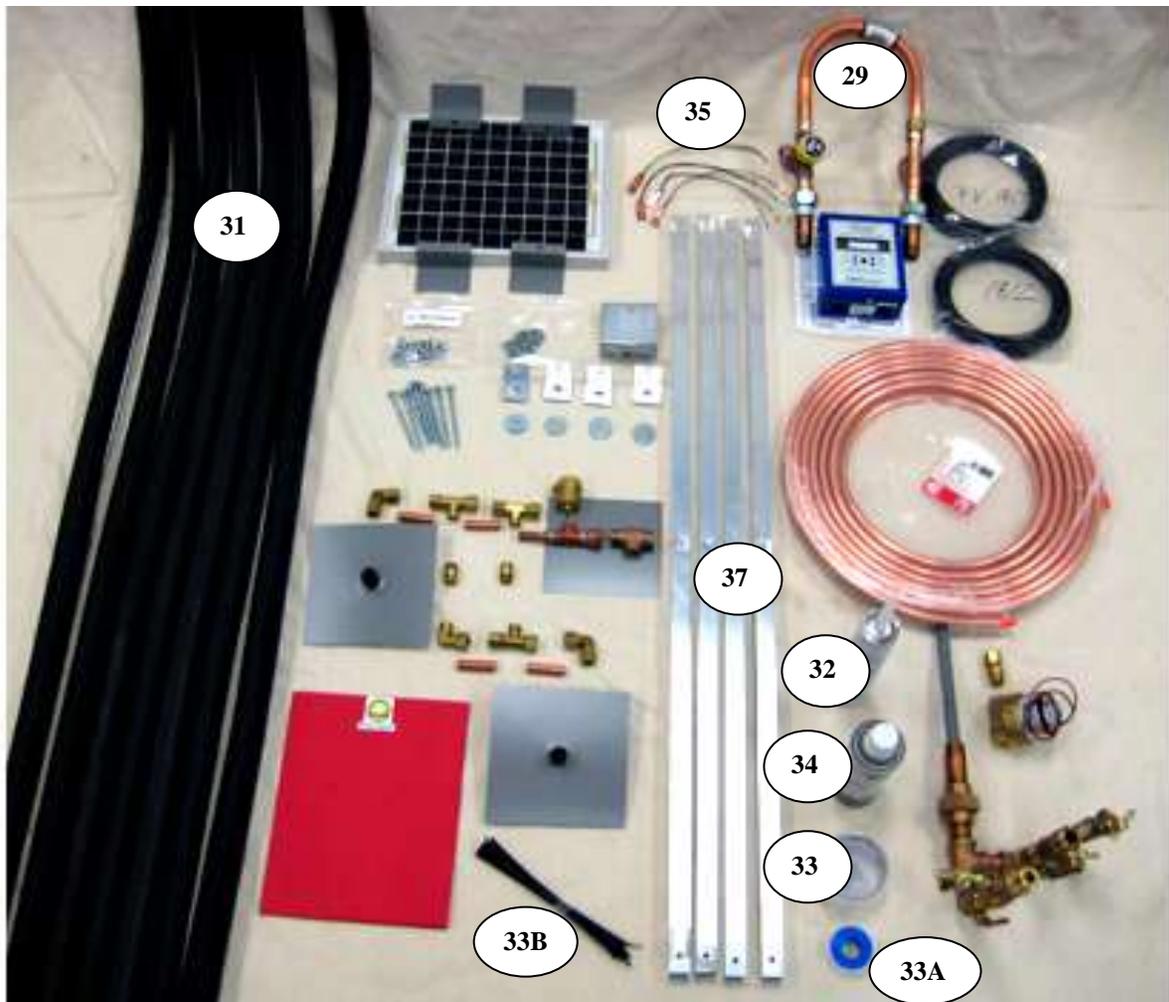


Platinum Skyline3 Option:

This is the Ultimate no solder Closed Loop system with 100% of the parts and insulation needed for a complete, installation including our Exclusive Skyline3 Vacation bypass valve and pre-soldered tempering valve assembly.

The Platinum Skyline5 system Includes 1 – 27 above plus 28 – 35 below:

28. Choice of 2 Standard and 24 Free Optional Collector Trim Colors – see color chart
29. Preassembled “No Solder” Tempering Valve assembly with flex tubing connections.
30. 2 port tank top connect available at no additional cost (substitutes for the bottom connect).
- 30A. 4 port tank top-connect available at no additional cost. (substitutes for the bottom connect).
31. 36’ of high temperature 5/8” x 1/2” wall Insulation (more if needed) + 6’ of 7/8 x 1/2” wall insulation.
32. Tube of high quality Polyurethane Roof Sealant.
33. Aluminum tape to cover and protect outside lines.
34. Color Matched can of trim paint to paint outside aluminum insulation cover, rails, etc.
35. 2, 10 K sensors for a total of 4 Differential Controller Temperature Readouts.



Special Component Description Page

12 Volt IMC Eagle 2 Differential Controller (DC04): This is a new innovation in 12 volt PV pumped solar systems that optimizes system performance by giving ideal control over the pump turn on and turn off cycles. This prevents the pump from turning on too early or running too late. It is standard on the Gold and Platinum system upgrade packages and can be deleted for a credit.



This Premium Quality differential controller electronically senses temperature differences using 2, 10K thermistors (sensors), it is not a thermostat. Whenever the collector is 12 degrees F or more hotter than the temperature in the bottom of the tank, the controller turns on the pump. When the difference gets to 4 degrees F or less, it turns the pump off. The differential On as well as the tank temperature High Limit is adjustable. A total of 4 Temperatures readouts are available with 2 extra 10K sensors.

12 Volt Eagle 2 with Transformer Powered Recirculation Freeze Protection

Operation: When there is a Freeze threat, any temperatures expected below 25 F, plug in the transformer to activate the recirculation freeze protection function of the controller. Note the Transformer can be left plugged in but defeats the PV Power when plugged in. The PV panel and transformer have blocking diodes installed in the controller to protect against reverse flow.

Top Tempering Valve Assembly (MVT3): This pre-soldered assembly saves a lot of time by having the Tempering valve already soldered to a flex tube assembly that connects to the top of the tank and to the hot and cold domestic lines. A flex tube and Tee assembly connects the cold water feed to the cold side of the tempering valve. Two 45 degree hot and cold 3/4" MPT connections work with standard flex lines for most applications. (insulation is to be applied) This pre-assembly comes standard with the Platinum Upgrade



Laing D5 "Ecocirc" Electronic 12 Volt Pump (D571): Highly efficient, the Ecocirc solar can be connected directly to a photovoltaic panel and is characterized by its small size, high efficiency, extreme low power consumption and its Maximum Power Point (MPP) tracking. The shaftless spherical motor technology provides maintenance free and quiet service life. This pump is perfect for single family home thermal solar systems or any circulation pump application where conventional power is not available.

The principle of the spherical motor, which was invented by Laing, is fundamentally different from conventional canned motor pumps. The only moving part in a spherical motor is a hemispherical rotor/impeller unit which sits on an ultra-hard, wear-resistant ceramic ball. There are no conventional shaft bearings or seals. This eliminates bearing noise and seal leaks. This pump is robust with an estimated service life in excess of 50,000 hours.



The self-realigning bearing is lubricated and cooled by the media. Maintenance is not necessary under normal conditions. Even after prolonged shutdown, the pump will start reliably. All parts exposed to the fluid are completely corrosion resistant. The Ecocirc Solar pumps are the first and only spherical motor pumps with self-optimizing performance to maximize use of available power of a solar PV panel. Every three seconds the processor will modify its operating point on the voltage-current curve of the PV panel to find the point of maximum performance. This is called the "Maximum Power Point" (MPP). At this point, the pump achieves the maximum rpm and therefore the maximum performance. There is no need for a separate performance device required. The Ecocirc Solar pump will always find its best operating point under any given light and temperature conditions.

**IMPORTANT NOTES:
BEFORE STARTING INSTALLATION
PLEASE CAREFULLY READ THIS ENTIRE MANUAL FIRST!**

CHECK WITH YOUR LOCAL BUILDING DEPARTMENT FOR CODE COMPLIANCE FOR THE INSTALLATION OF YOUR SOLAR WATER HEATING SYSTEM.

In all cases where a firewall (drywall) is penetrated, it is important to seal the hole. A good general rule is to always fill in and seal around all holes made for solar lines to prevent heat loss and to maintain fire stops.

Properly support all piping according to local code.
As a rule, support copper pipe every 6'.

SAFETY FIRST!!

USE CAUTION!!! Do not attempt to self-install without help if you have ANY back or physical limitations!!!

GENERAL WARNINGS:

Remember! A Collector in the Sun Can Be Very Hot – Cover it to Prevent Burns From Hot Copper Tubing and Very Hot Fluid Coming Out of the Tubes.

As the collector has some sharp metal edges and corners, use caution when handling the collector.

ALWAYS USE COPPER TUBING, NEVER PEX OR OTHER PLASTIC TUBING AS THEY MAY BURST FROM STAGNATION TEMPERATURES.

This manual assumes that the installer has good mechanical experience and can confidently use hand tools, building materials and adhere to safe building and installation practices. Do not install this system alone without someone knowing where you are and what you are doing at all times.

SolarRoofs.com does not assume responsibility for any loss, or injury directly or indirectly, associated with the installation of this system.

SolarRoofs systems are easy to install; however, problems resulting from a failure to correctly install the system according to the following instructions and to maintain it according to the operation and maintenance manual are not covered by the warranty.

COLLECTOR LOCATION, ORIENTATION AND TILT

Your solar water system will be providing savings for your family and adding value to your home for decades to come. Because the sun rises in the east, crosses over the horizon on the south and sets in the west, you want your collector to face as much to the south as possible. **Your system needs the most sun it can get!**

As long as the collector angle (known as tilt) is at least 14 degrees up from horizontal, (a typical roof angle is 22 to 28 degrees) additional tilt usually has little effect on total year round performance. **The exception** is in areas with very sunny winters (as in most areas of Colorado) where a higher angle, (facing the collector more directly into the winter sun) can help year round performance.

In most areas with **heavy winter overcast**, a solar collector's orientation on a low pitched roof can face anywhere from 45 degrees east to west of south without losing more than 8% of the energy it would have

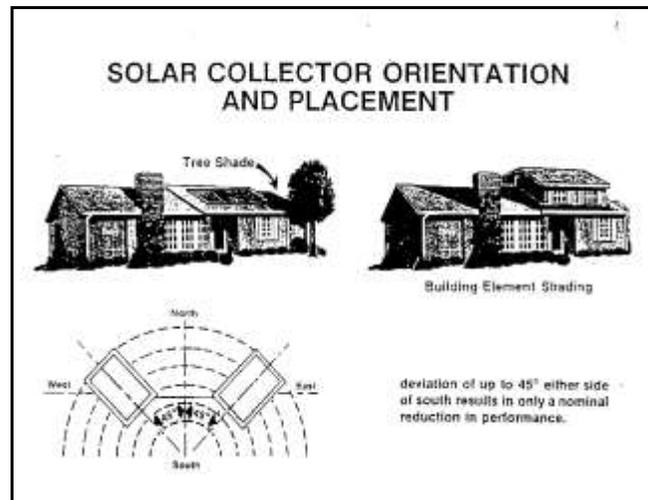
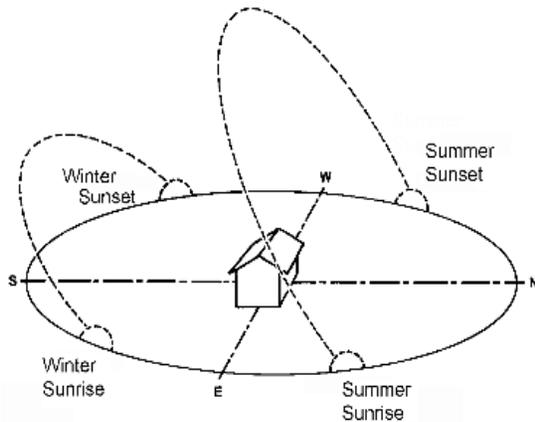
produced if it were facing directly south. At 90 degrees east to west of south the loss is closer to 20%.

Exceptions include easterly facing systems in areas with a lot of morning fog and clear afternoons where south facing or west facing would be much better. The opposite can be true if sunny mornings are very often followed by rainy afternoons.

Take these facts, and your tubing run to the tank, (see 7.0.) into consideration when locating your collector and consult with us if you have any questions.

ROOF CONDITION:

The condition of your roof should be good although one of the features of Skyline system is that removing and replacing the collector is relatively easy for re-roofing.



OVERVIEW - THE BASIC INSTALLATION STEPS:

THE BASIC INSTALLATION STEPS

A total of 8 to 16 hours required to install, depending on situation and experience

* = supplied with Gold and Platinum Packages

1. Unpack collector, check and inspect collectors, layout all parts and get familiar with them according to the kit you purchased. Compare the parts to the list above. Separate the roof parts from the storage tank parts and prepare all tools and tool boxes for installation. If days are hot, prepare to do the collector installation early especially to prevent damaging composition shingles. See page below.
2. Collector placement on roof located, rafters located and marked, end mounting rails* with Ell brackets and fender washer loosely lagged and sealed into rafters or spanner board top and bottom. If 20-01 collectors, do the same with the center rail. If U brackets are being used, loosely attach them to the rail with large fender washer.
3. Starting with the top collector, place onto mounting rail with top trim over the El bracket so the Ell bracket is between the trim and the frame, snap the bottom of the collector beneath the U bracket. (the silver package does not have U brackets and only Ell brackets are used, measure carefully in from the end and pre-attach the Ell bracket under the trim. Repeat the above as needed and place the bottom collectors lower trim over the El bracket so the Ell bracket is between the trim and the frame. Do not use any Tec Screws yet until the collector feed and return unions are lined up and attached.
4. Collector compression unions connecting air vent, pressure relief valve and components installed, two 1 1/2" holes drilled into roof for hot feed and cool return lines. Shingles trimmed and "Roof Boots" installed under shingles and into roof holes.
5. Collector cool feed (bottom compression fittings) and hot return lines (top compression fittings) installed through roof boots to tank area. *Eagle 2 sensor is installed 2" inside the top return hole and shielded wire run to tank area. Insulation partly installed before tubing connections are made. PV panel installed and PV wire connected and run to water heater area. Sensor and PV wire is tie wrapped to the outside of the pipe insulation run to the tank.
6. For bottom connect*: Water Heater Element turned off, water drained, lower element disconnected from upper element and capped off, lower drain removed, water lines connected including installation of the Mixing valve. Brass fittings with valves connected to tank drain, pump installed, collector cool feed (from pump) and hot return lines connected by compression union.
7. Water heater refilled, solar loop purged of air, pump wired to PV panel through control box or optional* 12 volt differential controller, wiring finished. Finish insulating lines, Fill Tank and turn element back on.

COLLECTOR CONFIGURATIONS

10 s/f Skyline 10-01 collector configurations, 20, 30, 40, and 60 square foot arrays, stacked and side by side. 10-01 collectors can be offset (see picture below bottom right) where the situation requires.

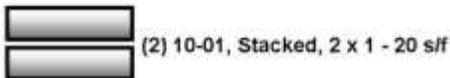
Skyline 10-01 (10 s/f) Collector Configurations

Standard collectors feed / return at one end which can be Left or Right, side by side both feed / return from the Center.

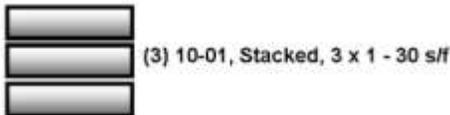
Our "Skyline" 10-01 collectors are also available in flow through configurations as well as horizontal and vertical drain-back configurations upon request only. Standard collector configurations are shown below.

Optional Accessories such as mounting rails or tilt kits are available in the Shopping Cart. You may use the corresponding number (see below) to either search for the proper part in the shopping cart or to ensure you have the correct part number before adding the part to the cart (prices are shown in the shopping cart).

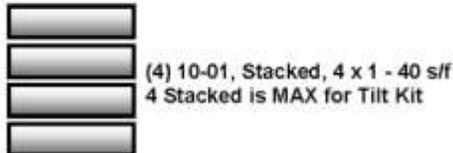
10-01 Stacked Configurations



Optional Accessory Part#s:
Mounting Rails: MR02-2
Tilt Kit: TK02-2



Optional Accessory Part#s:
Mounting Rails: MR03-2
Tilt Kit: TK03-2



Optional Accessory Part#s:
Mounting Rails: MR04-2
Tilt Kit: TK04-2



Optional Accessory Part#:
Mounting Rails: MR06-2

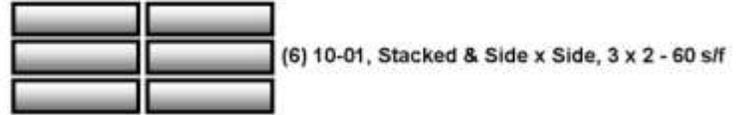
10-01 Side by Side Configurations



Optional Accessory Part#s:
Mounting Rails: MR01-4
Tilt Kit: TK01-4



Optional Accessory Part#s:
Mounting Rails: MR02-4
Tilt Kit: TK02-4



Optional Accessory Part#s:
Mounting Rails: MR03-4
Tilt Kit: TK03-4



The 20 s/f Skyline 20-01 can be configured in 4 different ways:

Skyline 20-01 (20 s/f) Collector Configurations

Standard collectors feed / return at one end and can be Left or Right, side by side both feed / return from the Center.



1, 20-01, 1x1



2, 20-01, 2x1 Stacked



3, 20-01, 3x1 Stacked



2, 20-01 side by side, 1x 2 (center feed all)



4, 20-01 side by side and stacked, 2x 2



COLLECTOR INSTALLATION

BE SECURE AND USE CARE!!!

Good procedure suggests that you always secure your ladder to the gutter so it does not slip. Place blocks in the gutter so the weight of the ladder does not crush the gutter. Protect the surface of the gutter with a cloth to prevent marks.

WALKING ON THE ROOF:

Composition Roofs:

Do not damage hot composition roofs by walking on them when very hot or by walking in end of shingles or by twisting foot on the shingle.

Use soft sole shoes. Walk in the center of the shingle to prevent knocking off the brittle ends of the shingles. This care will keep the roof in good condition and prevent dangerous ball bearing like gravel and tar balls from making the roof treacherous.

Know how to walk on your roof if it is a special type such as Tile or Metal, ask your roofer or ask us.

Tile Roofs:

Stepping in the center of most Tile roof shingles will break them. Always put your weight on the last two (overlapping) inches of the tile and away from the side that overlaps the next tile (to avoid chipping off the delicate vertical overlap strip).

On barrel tile, step in valley away from overlap.

On some shingles, such as "Fire-Free", or shake, more damage is done stepping on the end than in stepping on the center.

Shake Roofs:

Shake roofs are usually easy to walk on but use care on shake roofs to not crack or break off brittle shakes. **Shake roofs, as well as most roofs, can be treacherous when wet.** Use extra flashing where needed to get under first ½" of tar paper. Use extra calk where needed.

Always SAFTY FIRST!!! Use safety ropes and stops on a steep roof, do not install collectors in bad winds. Secure ladders, protect gutters and do no damage them.

IMPORTANT NOTES:

Mark or tape hot line at both ends to insure proper hookup.

As the 20-01 collector is 12' long, it is important to place the line connection end so it is the shortest distance from the storage tank.

The collector can be flipped either way to be closest to your storage area. Remember that the feed line from the pump goes to the bottom collector connection and the hot return goes to the top collector connection as shown in the diagrams.

On an average, low pitch single story roof, one able person can safely install the Skyline collector. **Do not install this system alone, be sure someone knows where you are and what you are doing at all times.**

ALL ROOFS:

Never step on ridge cap or within one (1) foot of a valley – SEVERE DAMAGE CAN RESULT!

We recommend seeing the collector installation video available on the Website:

<http://www.solarroofs.com/videos.html>

Collector installation Components:

Note 10-01 collectors will have 2 sets of collector brackets instead of 3

Roof Kit contains:
 Mounting Ells and washers,
 3.5 or 4" Lags,
 Center U Brackets for 2 or
 more collectors,
 Color coded Tec Screws for
 securing Ell brackets and U
 brackets to collector,
 Low profile Roof Boots.



Gold and Platinum PV
 Parts Bag contains
 Brackets and hardware.
 See 9.0, Control
 Component Detail.

Plumbing Kit:

50' of 1/2" OD Copper,
 Pressure Relief,
 Coin (air) vent,
 Soldered adaptor,
 Compression fittings,
 1 Compression union
 body per extra
 collector,
 2 compression unions
 to connect tubing to
 tank.

Important Instructions Regarding Installing Compression Unions

1/2" OD Compression
 Union and Ell

Compression Ell

Nut with Ring Inside

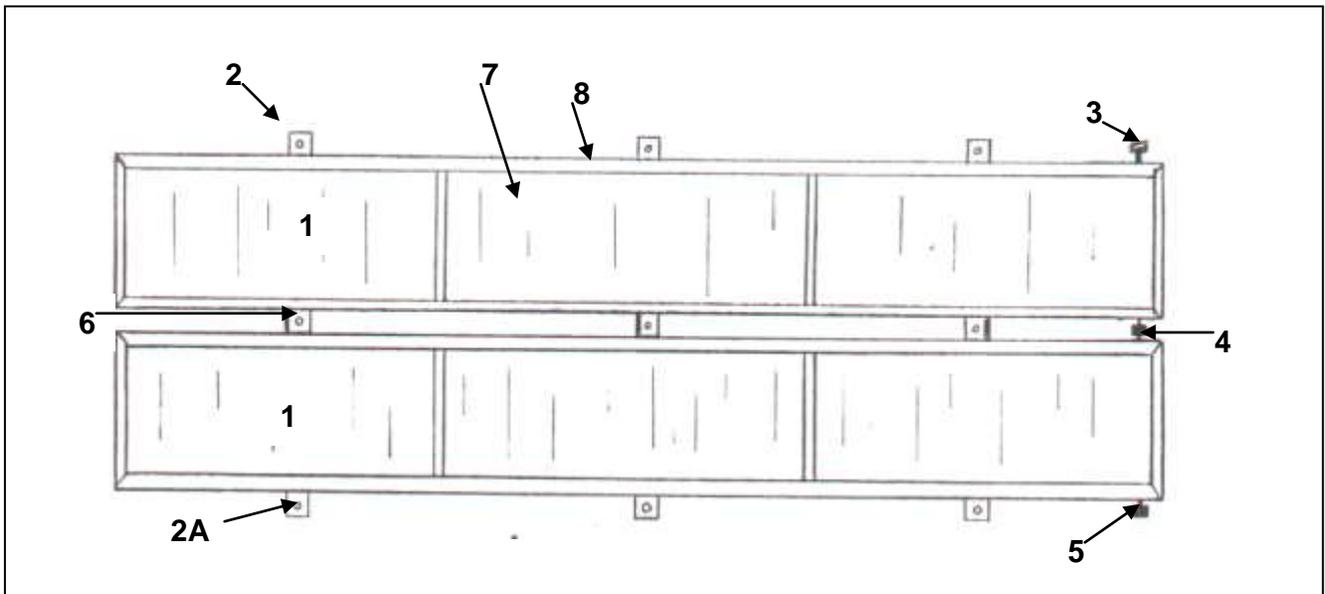
It is important to not over-
 tighten these fittings.
 Spraying a little silicone on
 the threads is helpful.

Nut, Ring, Union Body

**Tube must extend beyond ring
 about 1/4" and bottom out inside the
 compression body before tightening
 nut**

Collectors mount horizontally and Collector Mounting Rails go as shown below.

Two Collector 20-01 Top View (10-01 collectors use 2 rails about 1' in from the ends)



The Diagram above is a top view of two collectors installed together showing:

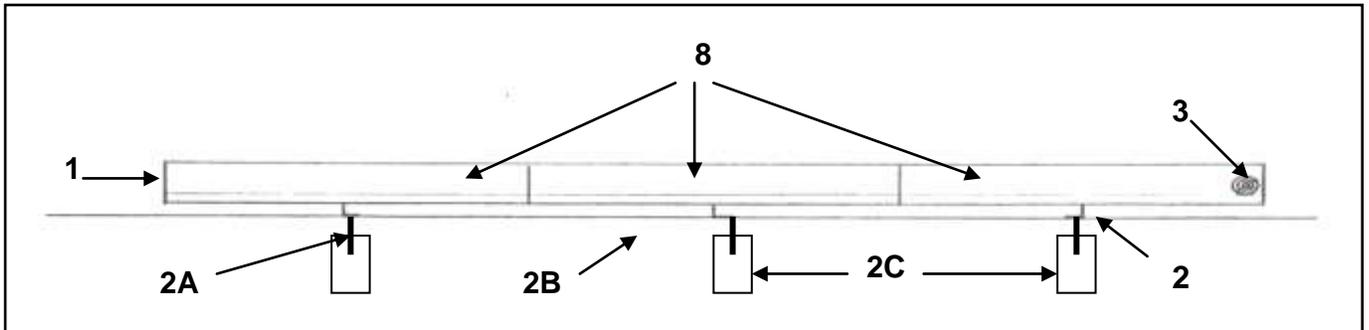
1. Two 20" x 12' Collectors mounted with connections to the right.
 2. The Mounting Rails with Mounting Brackets (3 rails and 6 Mounting Brackets plus 3 Quick Connect Clips (QCC) per additional collector set (6.), 3 two panel rails, 6 Mounting Brackets and 3 QCCs shown in this diagram).
 - 2A. Mounting Rail Lag holes top and bottom.
 3. The "Hot Out" Collector connection going to the storage tank.
 4. The between Collector connection.
 5. The "Cold In" Collector connection from the storage tank.
 6. The Quick Connect Clip bolts to the mounting rail here with the tabs overlapping the top of the collector.
 7. Collector Glazing (Polycarbonate)
 8. Collector trim sections.



Above: Allowing from 14" to 2' for collector overhang, find and mark Rafters for the Three Collector Rails, (shown in this picture are 3 rails for 3 collectors) Use a chalk line to get the 3 rails even at the bottom. Get the center rail as close to center between the end rails as possible. Using a hammer to "Sound Out" the rafters usually finds the rafters. If not, use a feeler bit (long small drill) to drill through the roof from the inside, just beside the rafter. **Be sure to squeeze caulk into all holes to seal them!**

Pre-Drill the bottom holes for the 2 end rails (which will be about 8' apart – you can use the lag itself to "pre drill"), squeeze Caulk into Lag Hole, Place end mounting rail with mounting bracket and washer over hole (above left). Drive Lags into holes but do not tighten. Carefully place the center rail along the chalk line, repeat the procedure for the end rails. Install the upper lags using the same procedure. Note: one and two collector systems have lags at the top and bottom of the rails. Three and four collectors use a center lag at the center of the end rails only. Other Quick connect clips use a carriage bolt.

20-01 Side View



The above Diagram shows a side view of the Collector installed on the roof and shows:

(Refer to Color Pictures for Details of Ell Brackets)

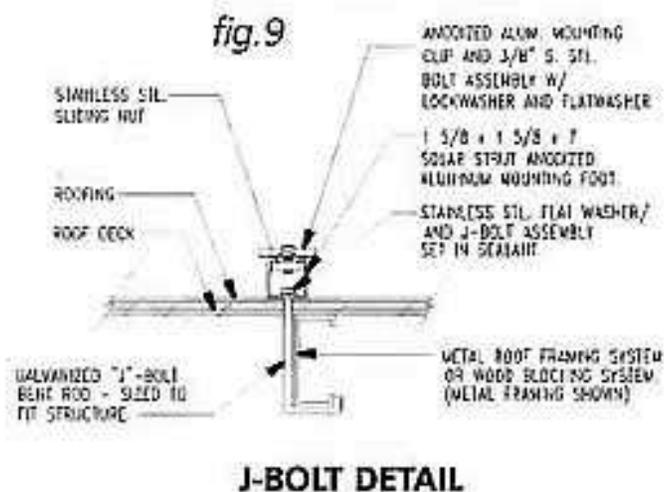
- | | |
|--|---|
| 1. Side view of a Collector. | 2C. Roof Rafter. |
| 2. Mounting Rails (3 per 20-01 collector). | 3. Collector feed or return connection. |
| 2A. Mounting Rail Lag. | 8. Collector Trim. |
| 2B. Roof sheathing. | |

LAGS AND RAFTERS:

For maximum strength, you want your mounting rail (2) lags (2A) to go into rafters. After locating the best area for the collector, “sound out” the roof for the rafters with a hammer and mark the rafter centers with chalk. On thick roofs, such as shake, you may need to drill a small hole from the underside of the roof next to the rafter to locate it from the roof and use measurements from thereon. On thin composition roofs, a good stud finder can be very helpful in finding the center of the studs.

It is best to “run the lag into the roof once, remove it, then fill the hole with caulk and run the lag with washer back in and tighten. Some installers like to pre-drill the hole with a smaller bit than the lag to prevent cracking shake shingles.

Note: For high Wind areas, use a lag into a “Spanner Board” between the rafters. For extra strength the spanner boards can be toe-nailed into the rafters. Another option is to use a “J” hook around a rafter but location options are limited with this method.



Tilt Kits:

See Tilt Kit Instructions Addendum included in Folder

Standing Seam Installations:

Consider using the excellent "S-5 Clamps. <http://www.s-5.com/home/index.cfm>



Tile Roof Installations:

See tile roof installation: <http://www.youtube.com/watch?v=GiJf1jgND7I>

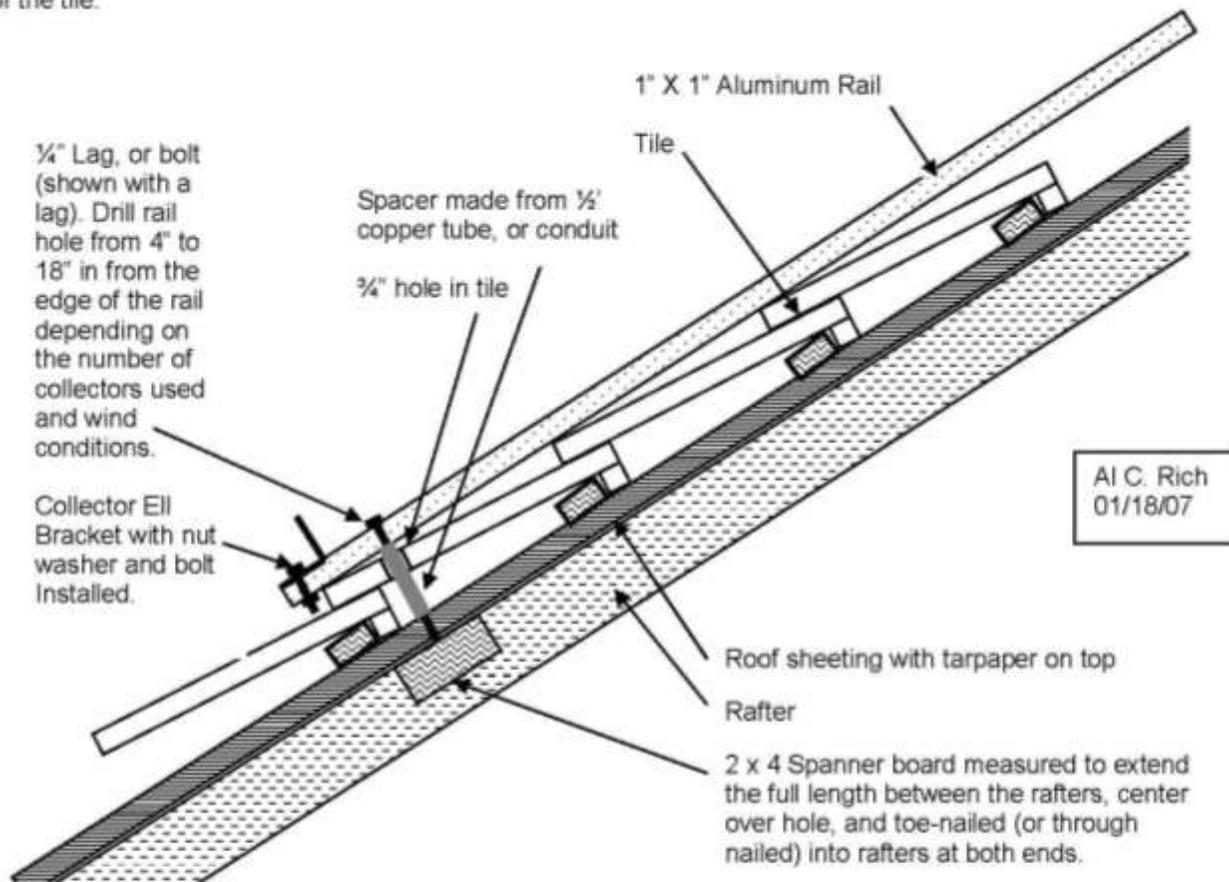


Please see drawing below. This system is the simplest design possible that supports the collectors and provides a permanent seal.

The left picture shows the positioning on the tiles; upper center the hole drilled just above the end of the tile below, bottom center, the calk filled tube on the tar paper and above the lower tile; upper right, the spanner board the lag is screwed into, lower right, toe-nail detail, in this case deck screws were used.

Simplified Tile Roof Installations of Lightweight Skyline Collectors

Lightweight Skyline collectors allow for a quicker and easier method of installation on tile roofs. The following shows a simple system where a hole is drilled in the tile, a spanner installed between the rafters, and a lag or bolt used to secure the collector rail. 1 and 2 collectors need 2 holes per rail, 3 and 4 collectors in high wind areas use a center hole, offset from the carriage bolt as needed for proper location. The same general procedure can be used with tilt kit feet as well. If installing on a Barrel tile roof, always drill through the very top of the tile.



Directions: (note also Skyline installation manual)

Locate best placement for collectors. Place front edge of rail about 1.5" over edge of tile and check upper end of rail to be sure eil bracket is not resting on the edge of a tile, adjust as needed.

A 3/4" hole will be drilled through the roof, using a 3/4" concrete bit and a hammer drill, measure just behind the tile overlap so only one tile is drilled through. Line up and drill a hole for all points of attachment.

Measure the distance from the top of the roof sheathing to the bottom of the rail, add 1/4" to the measurement and cut a 1/2" copper tube or conduit to be a spacer to fill this gap.

Drill a smaller hole through the tarpaper and sheathing. If using a lag, use a 5/32" bit, if using a bolt use a 1/4" or 5/16" bit. Toenail in a spanner board between the rafters with the hole centered. If using a lag, be sure it is long enough to go 1 1/4" to 1 1/2" into the spanner board. If using a bolt continue the small hole in the roof through the spanner board.

Drill a 5/16" hole thru the rail at the appropriate spot. From the bottom, carefully fill the spacer tube with high quality polyurethane caulk to about 1" from the top. Place the tube in the tile hole over the small hole.

Put the lag, or bolt through the hole in the rail (do not use a washer), place into the spacer hole. Put a gob of sealant around and into the 1/4" hole to seal. Place the lag or bolt through the small hole and, if using a lag, drill into the spanner until snug and the top of the rail indents to reduce the height of the head over the rail. If using a bolt secure into place using a nut and washer, double nuts are good, indent head into rail as above.

The caulk in the tube will squeeze out and seal the roof hole. Note: if using a center hole, as needed for 3 or 4 collectors in high wind areas, do not tighten until after caulk is in all tile holes.

GETTING THE COLLECTOR ONTO THE ROOF:

Use wisdom, when pulling collectors up onto the roof, have the collector at a good angle to the roof (out at the bottom). Protecting the gutter with a heavy cloth may be a good idea. Do not lean over the edge of the roof at all, simply pull and leverage the collector up onto the roof. The assembled collector is very sturdy but avoid “twisting” it.

If the edge of the roof is over 10 feet from the ground, the bottom of the collector may be placed on a sturdy object

or someone may be needed to boost the collector up to you.

On two story houses we strongly recommend two people for safety.

A sling can be made with sturdy rope going all the way around the bottom of the collector with shorter pieces going around the collector to secure the rope in place. Be sure to secure it very well and always have a secure safety rope you can grab onto. Have the second person push the collector up the ladder while it is pulled at the top.



Protect Edge of Roof with a Tarp and Lean Collector Against Roof



Keeping your body weight over the Roof, pull the Collector Up



Move Up the Roof as you Pull the Collector Up a Foot or so at a Time.



Balance the Collector in the Center and Carry to Installation Area.



To the Left, the 10-01 is easy to just carry up a ladder under one arm.

To the right are 2, 10-01 stacked collectors installed on the rails. The union between the collectors is being connected before the brackets are attached.



A NOTE ON MAKING TUBE CONNECTIONS:

The tube connections top and bottom shown in top view as 3 & 5, are made at the top and bottom of ONE end of the collector. The connections can be at either end of the collector simply by placing the collector end left or right. When two or more collectors are used they also connect at the same end (4).

Make sure you do not have a rafter directly under the collector feed as the feed hole is 1 and 1/2 inches below and in from the end of the collector.

MOUNTING RAIL AND MOUNTING BRACKET INSTALLATION STARTING WITH SINGLE COLLECTOR:

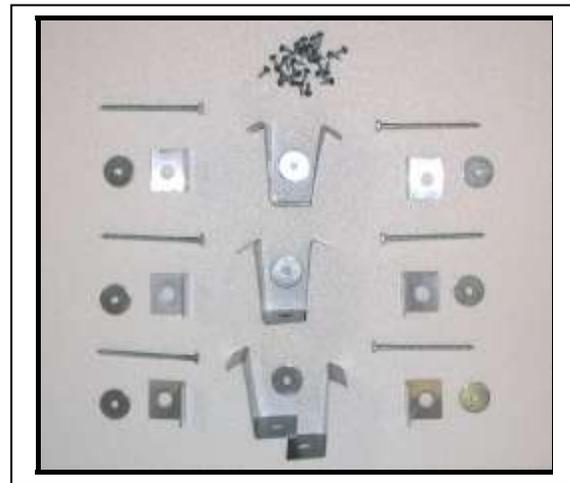
A single 20-01 collector is attached to the roof by three mounting rails and 6 mounting Ell brackets.



Position the Ell bracket between the trim and frame so it is CENTERED over the Lag hole. Install the collector onto the rails with the mounting bracket tab UNDER the trim and BETWEEN the frame. The small bend at the bottom of the trim makes inserting the mounting bracket easy. Be sure to press the collector all the way down on the mounting rail and secure with two 1/4" color coded self tap screws evenly just above the small bend in the trim. **Be sure to catch the tab with both screws!**



Above: Top Ell Bracket in place and ready for top collector to be installed.



Above: Complete Collector mounting kit for 2 collectors. 3 Ell brackets bottom, three U bracket sets per additional collector and 3 Ell brackets top.

Note: 10-01 collector has 2 sets of each.

Two, Three and Four Panel Mounting Rails and Tilt Kit (two collector maximum per tilt kit):

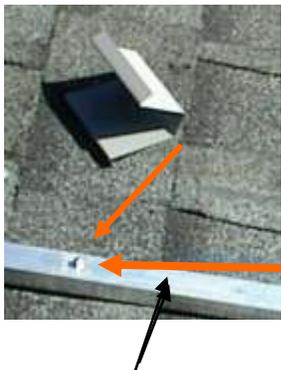
For installing two to four collectors or when two collectors are installed on the optional tilt rack, a special Quick Mount clip (6) is used between the collectors to firmly hold them onto the mounting rail. All holes are predrilled. With a tilt kit sets of 1/4" nuts, bolts and washers are supplied as needed in addition to lags to bolt the tilt kit together and secure the angle brackets.

The Quick Mount clip allows mounting of two collectors on the two panel-mounting rail or the heavy-duty tilt rail without needing to screw a mounting bracket tab into the side of the collector.

The U shaped clip with outward tabs that go over the edge of the two collectors is secured with a bolt in the center. In high wind areas, it is recommended that the clips be Tec screwed into the frame through the glazing with 2 screws.

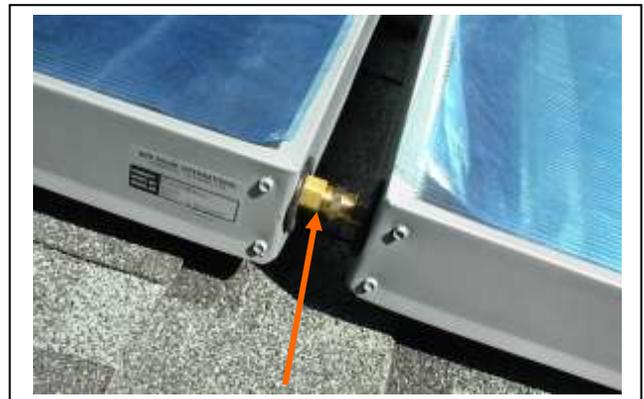
Notes on Two, Three and Four Collector Flush Mount Installations:

Place the first collector in place with mounting bracket tabs inserted for final assembly. Tighten down the lags. Place three Quick Mount clips in place over their rail lag hole locations. Partially install the lags to hold the clips loosely in place. **(you will need an extension to your lag driver to get between the collectors)**. Slip the next collector under the clips, connect the compression unions (4) so alignment is assured and then tighten down the lags. Repeat until all collectors are installed.

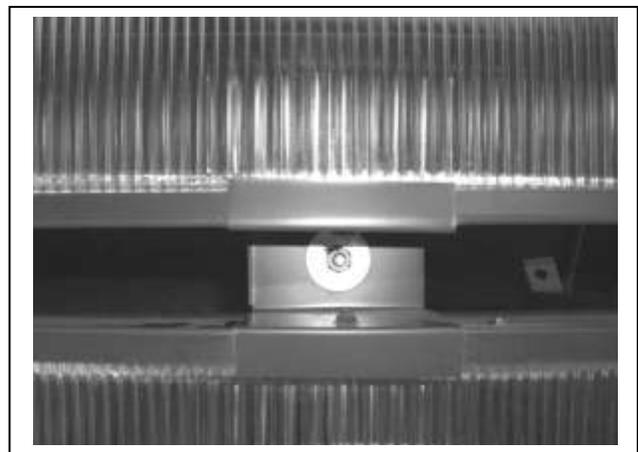


Quick Connect Clips (QCC's) are supplied in **One or Two pieces** with the single piece shown. Shown, in the top right picture above, is how they will be laid out.

To the left the U bracket is shown next to the rail with carriage bolt. **It is easiest to remove the nut before placing the collectors on the rails.**



Line up the collectors so the center union body can be installed. Using the threads on the union can help to pull out the nut on the header. It is a good idea to cover the collector with a blanket or sheet so the Nut doesn't get to hot.



Being sure the trim is pushed in, secure the U bracket with 1 tec screw going through the pre-punched hole in the bracket, trim and frame. This makes a very strong connection.

FLASHING IN UNDER SHINGLES

**For Tile and other roofs, consult with the Factory.
For Composition and Cedar Shake Installation:**

ACRSI supplies two special roof “Flashings” which are used to make a waterproof seal for the solar collector feed and return lines. These flashings easily slip under a composition or shake shingle with minimum cutting.

The tubing hole is large enough for the 1/2” od copper

pipe to easily slip through and the small space left can be easily sealed with caulk and further covered with insulation. The base of the flashing can flex and be moved in different directions.

The 8” aluminum base is usually large enough to make a watertight seal and can easily be flashed over by a larger aluminum sheet when needed. It is recommended that a 1 1/2” hole be drilled for the tubing hole.

“Roof Boot” Flashing and Waterproofing Details

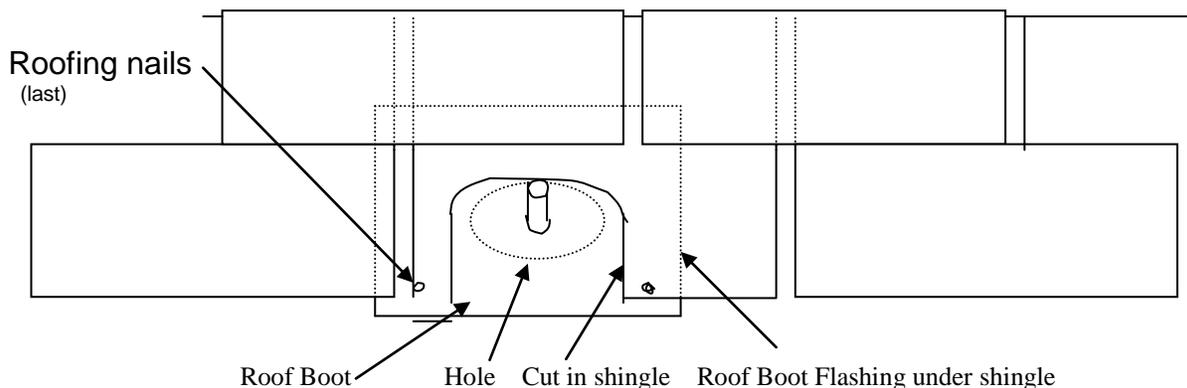
The 2 aluminum flashings supplied with the system are easily installed but require careful alignment to assure a good fit. It is recommended that up to a 1 1/2” hole be drilled to give “working room” when installing the roof boot. **Spacers are included with flush kits to make boot installation easier. Pre-fit roof connections prior to drilling (see Section 8, top and bottom connections).**

NOTE: sound out your roof to be sure no rafters are under where holes will need to be drilled!

Preposition the roof boot where it will go when the pipes are connected to the compression 90 in its final

“out” position. Mark the center of the hole, remove the fitting and place out of the way. Using a 1 1/2” hole saw or paddle bit, drill the hole. Carefully pry up the shingle and slip the Roof Boot under the shingle so water will freely flow over the roof boot.

If needed, add aluminum flashing to assure a watertight installation (especially needed with Cedar Shake). Caulk the sides as needed and it is good to put two roofing nails in the bottom of the boot to secure it AFTER the pipes are installed and fully secured.



Note that Roof Boot is UNDER the shingles at the top and most of the sides so water flows over the top. The shingle is cut down from where the hole is drilled.



Use a “lifting Tool” with smooth edges to go under and lift the shingle without cutting it. Lift shingles before installing collectors.



Drill a 1 1/2” hole 1 1/2” in and centered 2” below the edge of the collector. Slip flashing under shingles.



Properly placed, the feed line is right above the flashing tube hole. The edge of the collector is 1 1/2” above the lower edge of the rails.

Making Line Connections – See Pictures Above

Parts description primarily Apply to Gold and Platinum Levels

Line connections are easily accomplished using brass compression connectors.

When using compression connectors, be sure a small amount of tubing material is showing on the outside of the ring and that you use a small amount of Teflon Tape on the joining surfaces before tightening. Be sure no tape gets inside the tubing. **See Section 6.**

Preparing the Collector

Pull the Absorber tubes fully out of the inlet and outlet holes. The absorber fins should line up side beside in the collector.

Vital: Be sure tubes line up before putting Mounting Tec Screws into the Collector!

Collector Connections:

See 6.0.

Collector Top Connection:

At the collector top connection, connect a Tee compression fitting. Attach the pressure relief valve and air vent in the end of the Tee. Pressure relief should face down and the air vent up. The copper tubing may be installed into the Compression Tee, through the hole in the flashing later filled with caulk and insulated.

Tighten, but do not over tighten the connections. Be sure the line with the pressure relief and other valves on it are parallel with the roof. As mentioned, the pressure relief valve should be tightened so it faces down directly onto the roof, onto the supplied aluminum splash sheet, for safety. The coin vent must face directly up, it is normally closed tight and is used for manually releasing trapped air in the top of the system.

Bottom Connection of Collector:

When the end of the union is flush with the edge of the collector, alignment in the collector is correct.

Temporarily put in the 90° compression union at this point and drill a 1 ½” hole directly below it for the roof boot flashing to be installed.

Gently lift the edge of the shingle with a pry bar or trowel, cut the shingle as needed and slide the roof boot flashing into place. The copper tubing will be installed through the hole in the flashing later and insulated.

NOTE: The hole in the side of the collector will be covered with insulation as a final step. All insulation over fittings is done last, after the system is pressurized and all fittings checked for leaks.

Paint outside insulation with Latex paint or cover with aluminum tape to protect it from UV degradation.

The 50’ roll of ½ OD copper tubing (see below) is easily unrolled and straitened by placing it on the ground and unrolling it as you lightly step in the unrolled portion.

It is sometimes easiest to feed the pipe down through the roof boot flashing and into the tank area.

A variety of techniques can be used depending on the situation such as needing to pull the pipe through an attic where it may need to come up from the bottom and be fed through the roof.

SC01 Stacked Array Installation Kit

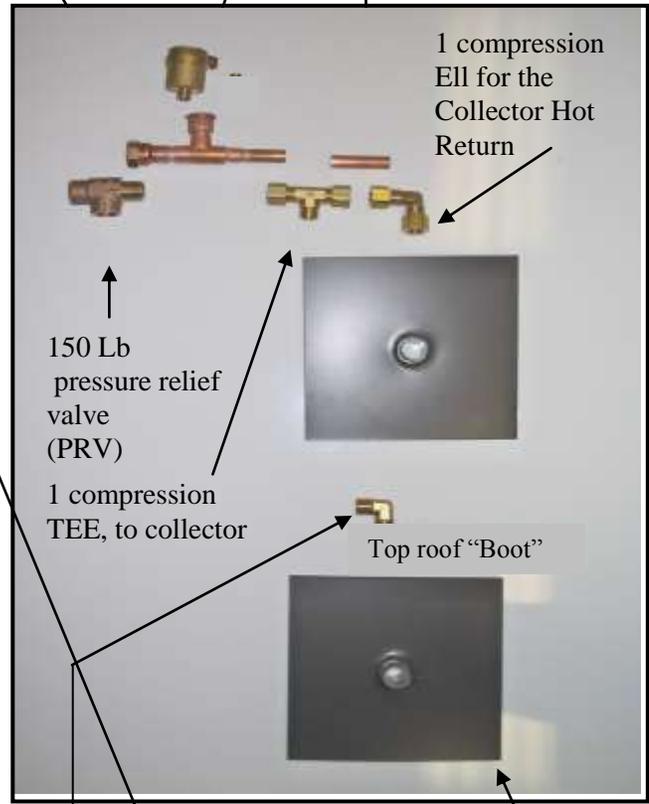
Loosely assemble your kit, per the following pictures, to locate the exact location of your roof penetrations and then follow the flashing and roof boot installation instructions.

SC01 - Stacked Collector Array Installation Kit

Pre-soldered adaptor for Pressure Relief Valve and Coin Vent / Air Vent 2" stick of copper



Feed Ell from Pump



1 compression Ell for the feed. Bottom Roof "Boot"

FV04 Freeze Valve option for SC01 Includes: Dole Freeze Valve, Tee and Adaptor.



SSC1 Side by Side Collector Installation Kit

IMPORTANT SSC1 TIP: Before installing the last Top Left collector, lift shingle for the flashing to go under See: "Roof Boot" Flashing and Waterproofing Details. This array can be Side by Side and Stacked.

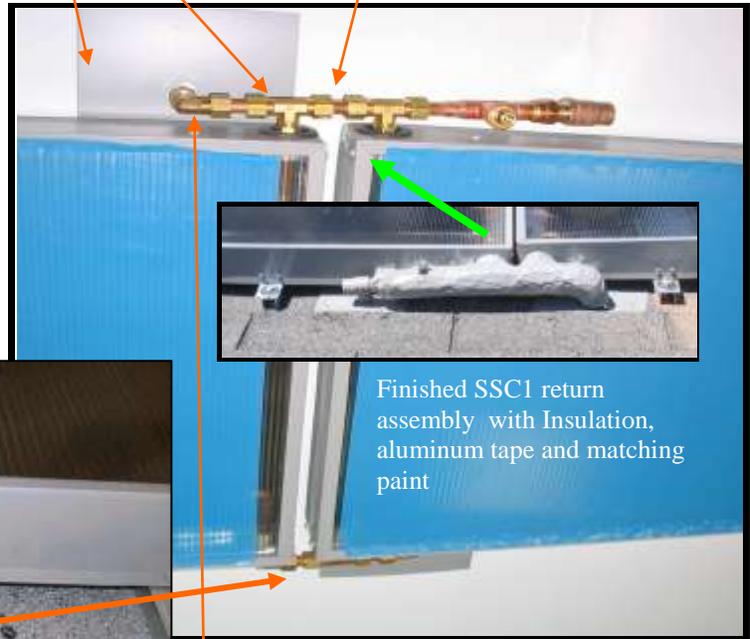
The SSC1 is the same as SC01 with addition of a Tee and 2" stick of copper for 2nd collector.

The SSC1 Feed has an additional Ell,

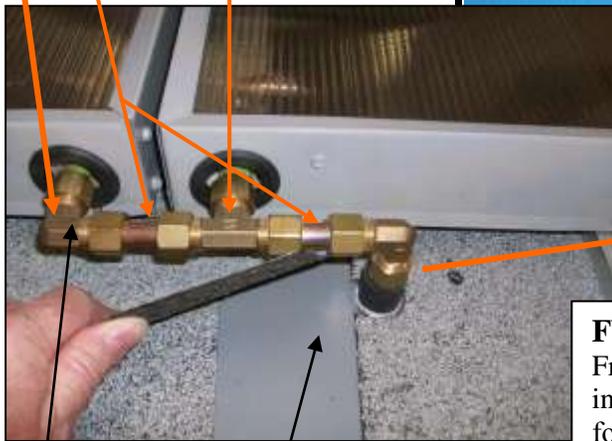
2 copper sticks

and a

Tee for the second collector.



Finished SSC1 return assembly with Insulation, aluminum tape and matching paint



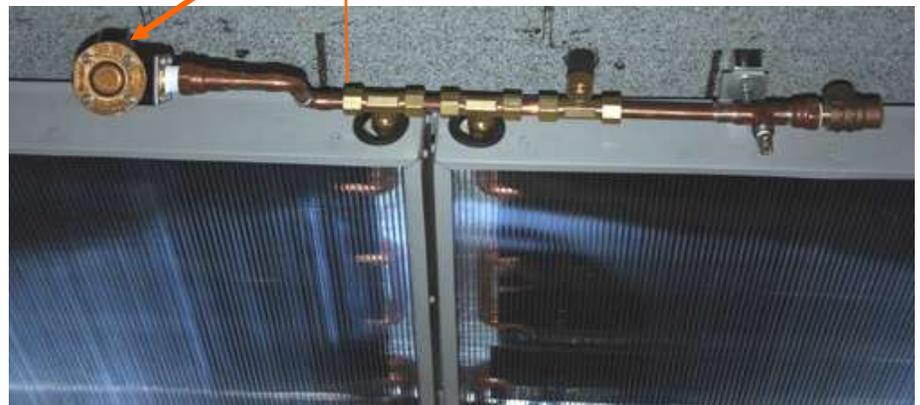
Roof boot can be hidden under the shingle as shown. 2 roofing nails at the lower corners are recommended. Be sure the top of the boot is at least 1/2" under the shingle above.

FV05 Freeze Valve option for SSC1. As the Freeze Valve must point down, this special adaptor includes an additional TEE and presoldered bend for the 45F "Dole" Freeze Valve.

(This view is from the Top looking down, Actual part may vary from picture)



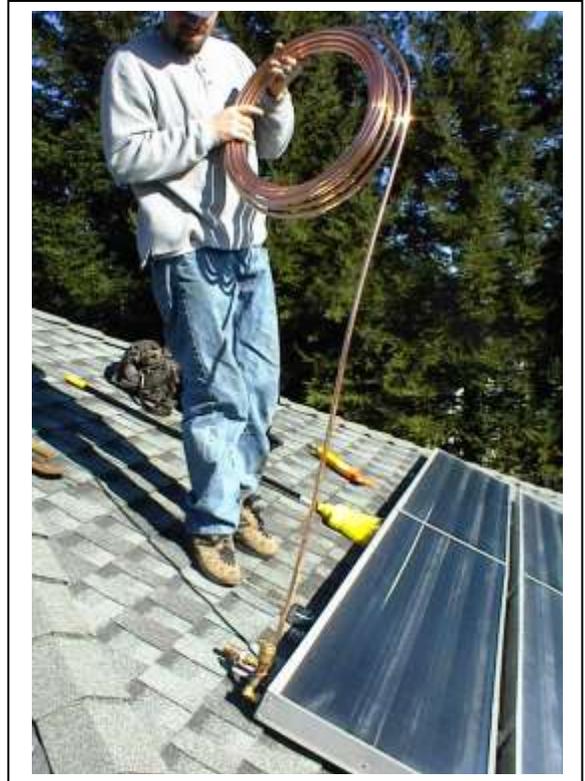
Finished SSC1 feed assembly with Insulation, aluminum tape and matching paint.





To prepare for the pipe runs, straighten the copper lines by putting a foot on the end and carefully unroll the tube and keep the line straight.

Carefully unroll the tubing through the roof boot into the attic. If available, have a partner guide the tubing to the tank being very careful not to kink the line. When working alone, it may be easier to unroll the tube in the attic or first floor and send the tubing up and through the roof boot from the attic.



SRCC requires a splash plate under the pressure relief valve shown here glued to the shingles under the PRV outlet.

Fully insulate all lines. Press about 1/2" of supplied high temperature insulation into grommet hole to fully seal. Covering the insulation with aluminum tape and painting is recommended. Be sure to overlap top over bottom like the shingles for good water shedding.



Finished hot return (shown with optional freeze valve) to left and finished feed from pump on right



DETERMINE THE BEST PIPE RUN

COORDINATE THE PIPE RUN WITH THE BEST SOUTH FACING COLLECTOR LOCATION FOR THE SHORTEST RUN.

IMPORTANT: SLOPE all lines to DRAIN! It is important that all pipes between the collectors maintain a 1/4" per foot drop to prevent traps and assure that all fluid drains when the drain valves are opened.

COMMON RUNS

In many one-story homes, the run is a simple matter of going up into the garage rafter area and to the roof or going through a wall or ceiling into the attic.

Common pipe runs to the basement include runs adjacent to air return chases, plumbing and vent lines and through closets. **In a two story house runs can be challenging; however, it is amazing how often a good solution is at hand.**

CHASES: Look for pipe, fireplace and duct chases with room around them. The pipes can often be dropped down next to a duct, especially in a one-story house, in just a few minutes.

CLOSETS: Sometimes the easiest way to run the pipes is through closets (look for "stacked" closets in a two-story house). Since 1/2" copper pipes are fairly flexible, drilling through even many shelves with an angle drill is easy as alignment does not have to be precise.

NOTE: Copper pipes get harder, even brittle with multiple bending, bend your pipe as little as possible for the easiest installation! Unroll the soft copper in smooth even strokes and be sure the connections for the collector are above the roofline so no water could get into the house if the connection leaks.

DRYWALL: It is sometimes necessary to cut drywall at the floor or ceiling level in order to cut the holes in a fire-stop. Usually this hole can be made out of sight in a closet. After sealing the fire-stop, it may be desirable to make the remaining drywall removable by putting a simple frame around it and placing it back in place with a few finish nails.

INFILTRATION AND FIRE-STOPS: In all situations, remember that infiltration is one of the main

sources of energy loss in a house. In no way should the installation of a solar system contribute to this loss! ALWAYS seal up any holes made in the house envelope especially in the attic and fire-stops. Fire-stops must be properly put back in place so their important function is preserved. Converting to copper pipe for two feet on either side of the fire-stop may be required in some areas.

STORAGE: You will need to purchase a Rheem (Rudd or Richmond) Storage Tank, 80 Gallon with heat exchanger, Model # RH-81V080HE1.

You will need room to work around it and space for the solar hardware, usually a foot on the drain side of the heater is adequate. Install the tank connection components.

The Rheem Storage Tank is equipped with a top element only. To enhance your DHW efficiency, during the winter, first try using low flow showerheads and aerators and/or add a 220v switch to the top element. Another good plan is to use a 220v timer set to heat the water for two hours before you get up in the morning and for two hours before you get home from work.

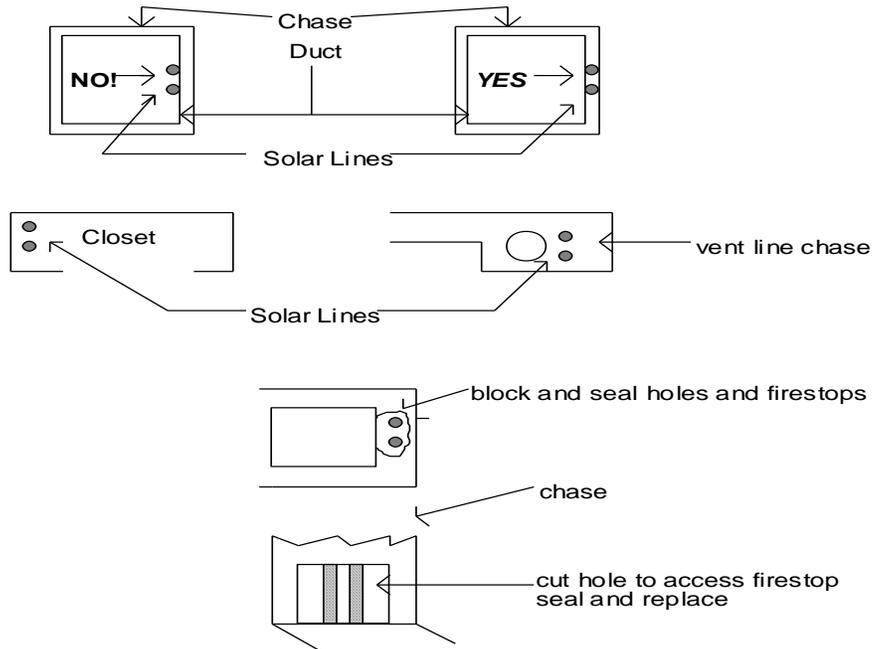
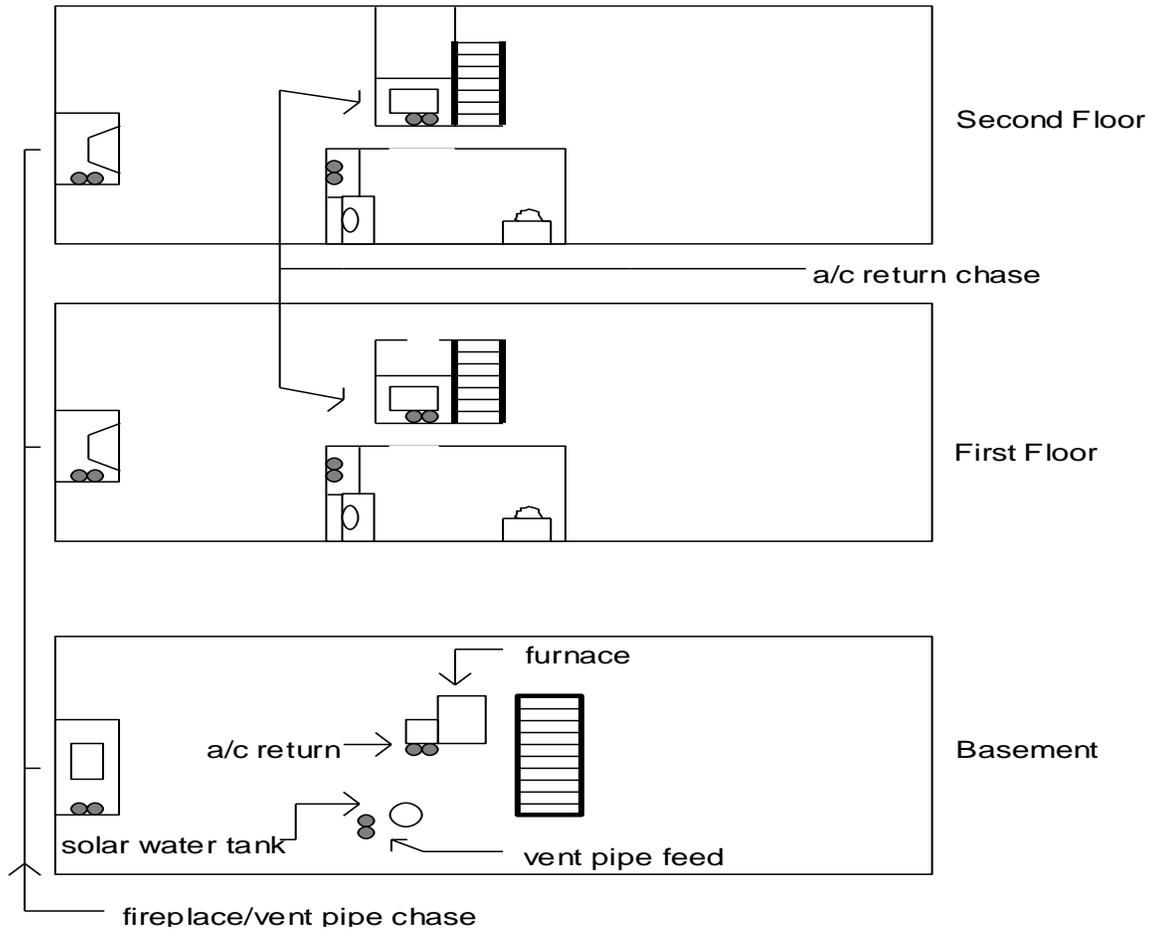
Try turning the power off during sunny summer days. You should have ample Hot water with 2 panel for a family of 3 and with 3 panels for a family of 4 or 5 on clear summer days.

INSULATION: INSULATION OF EXPOSED COPPER PIPES IS NEEDED. A MINIMUM 1/2" R-2.6 (closed-cell insulation)* IS NEEDED AND 3/4" R-4.5 OR BETTER IS RECOMMENDED. Check your state and local codes to see if any greater thickness is required ESPECIALLY IF REBATES OR INCENTIVES ARE INVOLVED.

Determining The Pipe Run (birds eye view)

*Look for the following:

Note: ●● = solar pipe run



TANK CONNECTIONS

9.0.

There are 3 types of tank connections. Standard is the “Bottom Quick Connect”, optional are the 2 or 4 Port “Top Connects.”

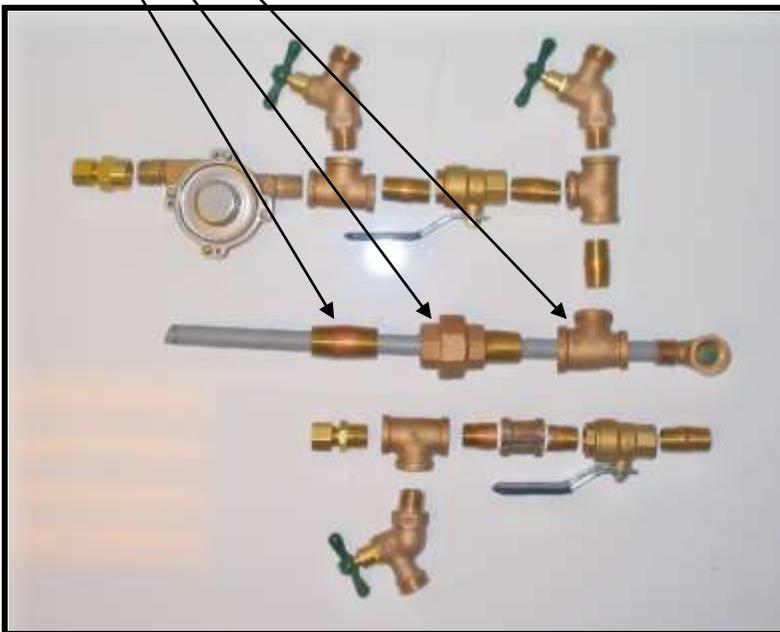
Note:

The bottom, “Easy Connect,” Assembly may vary from the pictures below as we work to improve the assembly process. Some components may be pre-assembled and or pre-soldered. The connection into the tank is a “Coaxial” (two way) fitting with the collector return inside the tank feed to the collector, see arrows below and on the next page.

When a single electric tank is used, the lower element is to be disconnected from the upper element to meet SRCC OG-300 guidelines.

Quick Tip Connection References (see following page for installation steps):

1. **Using 6 tight turns of Teflon Tape on all male threads**, install the tank nipple first,
2. Install the $\frac{3}{4}$ ” brass union second,
3. Install the $\frac{3}{4}$ ” x $\frac{1}{2}$ ” x $\frac{3}{4}$ ” brass Tee third,
4. Assemble the rest of the fittings as shown below and on the next page. **NOTE: Some assemblies may be Pre-soldered.**



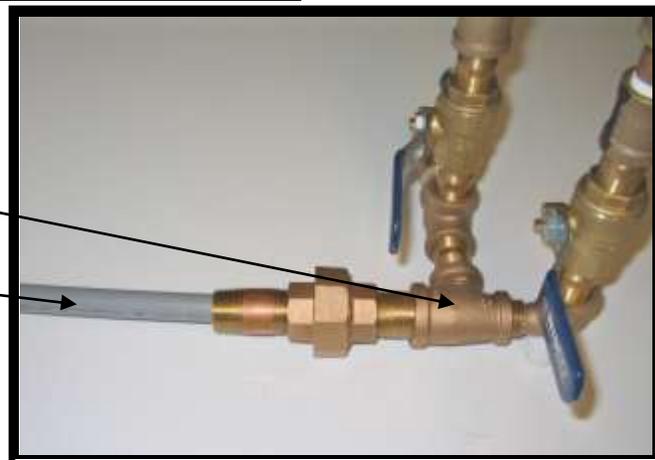
Tips: A little dab of pipe dope onto the OUTER surface of unions will help in sealing them, **do not get dope any into lines as pipe dope can Jam driver rotor!**

Install the pump head first without the motor, then finish assembling the feed and return side and install the motor last after all fittings are tightened.

Install the hose bibs last so they don't get in the way.

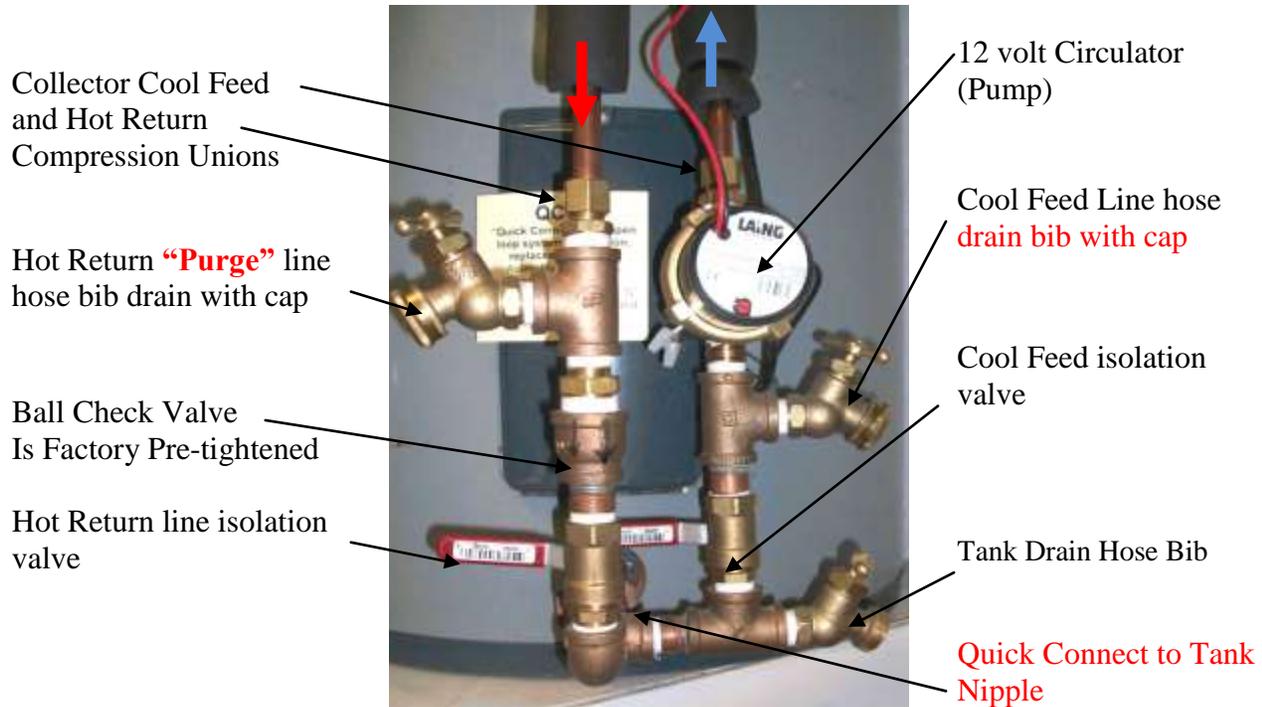
The Hot return gray tube slips inside the $\frac{1}{2}$ ” fpt part of the brass Tee to return solar heated water well into the tank.

Some components may have soldered assemblies but the final assembly will be the same.



The Tank connection is made by the following steps (see Pictures) **Use 6 tight turns of Teflon Tape on all fittings:**

1. Turn off Gas supply or turn Water Heater Element **off at the Breaker to the tank. Be Sure to mark it with a label "Do Not Turn On".**
2. Drain the water completely from the water heater (**CAUTION! It could be hot!**).
3. Remove the lower drain hose bib completely from the tank, teflon tape and install brass nipple.
4. Teflon tape, assemble and slip the "Easy-Connect Assembly" through the brass nipple and tighten the fitting. Assemble the brass fittings and valves as shown being careful to not block the next component to be assembled from turning.
5. Install the Pump Head onto the "Easy-Connect Assembly".
6. Cut and connect the collector cool feed and hot return lines using the unions supplied.
7. **Refill the Water heater**, open the isolation ball valves, check for leaks at the tank and on the roof. Tighten, but **DO NOT OVERTIGHTEN**, as needed.
8. **Purge the solar loop of air, by opening the "purge" hose bib on the hot return line until all air is out of the system. Pumps run dry are not covered by Warranty.**
9. Install the PV panel on the roof at the same angle as the collector and wire the PV panel into the circulator using supplied wiring diagram. Check for good circulation, only about .25 GPM is needed and the hot return isolation ball valve can be used to slow the flow. Proper flow can be determined when the Ball in the return check valve rattles only slightly.
10. Turn Electric Element or Gas back on.



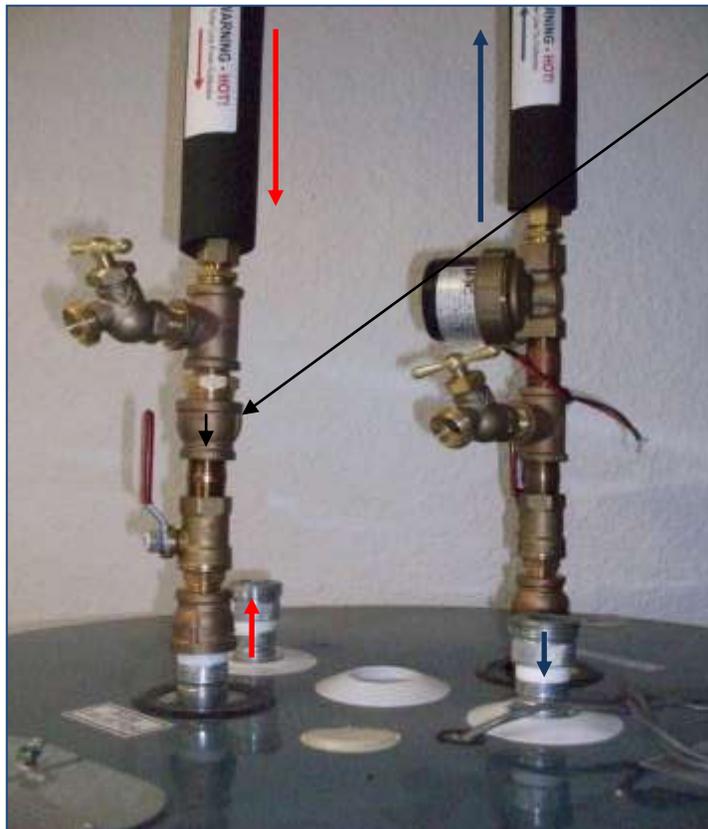
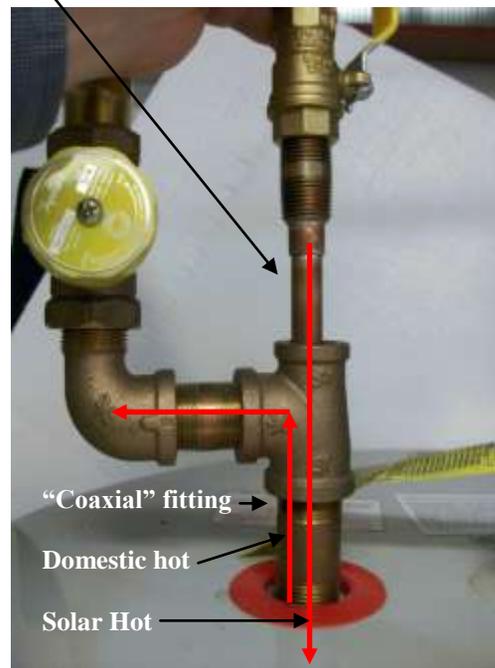
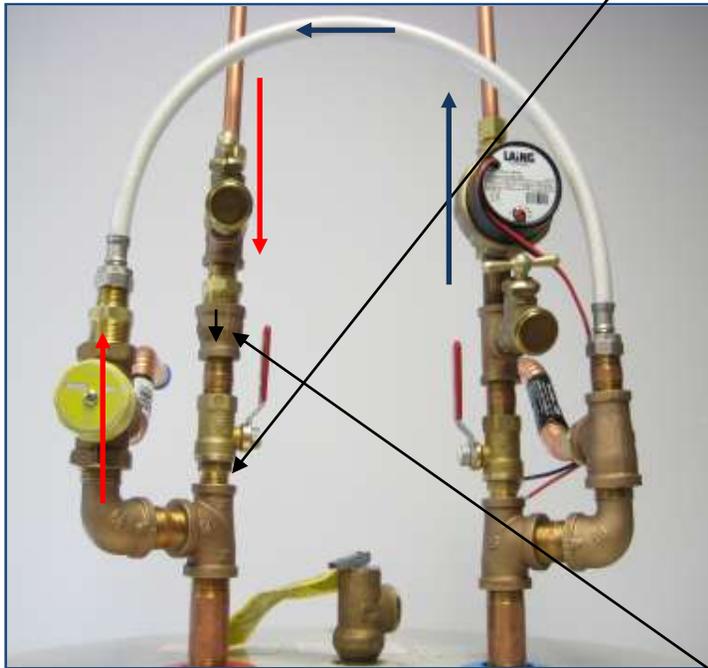
IMPORTANT: Charging the Open Loop Skyline3:

- Close the collector Hot Return Line isolation ball valve (bottom left).
- Connect a hose to the collector Hot Return hose bib to go to a pail or outside.
- **Open the Cold Feed ball valve and let water blast through the solar loop and out the Hot Return "Purge" hose bib until the solar loop is completely clear of air.**
- Close the hose bib, place a cap on it (be sure a cap is on both solar loop hose bibs).
- Open the hot return line isolation ball valve.
- Before finishing insulating the lines, pressurize the solar loop with water and thoroughly test for leaks. **Running a pump dry voids its Warranty.**

2 and 4 Port Top Connect Tank Installations: (Note: Some components may be pre-soldered. They will vary from the pictures below but will serve the same function.)

The top connects have the same function as the bottom connect and the same charging procedure. The 2 port top connect (top 2 pictures) is more complex because it has to have a standard tanks 2 ports serve the functions of the 4 Port Solar tank (bottom picture). A feature of the 2 port tank assembly is its "Dip Tube" which is designed to have the solar hot return water go into the tank at a point below the Element so cooler water from the bottom of the tank in the morning does not dilute hotter water stratified at the top of the tank. A "Coaxial" fitting allows the hot water to pass the dip tube. **Note:** 2 port top connect assemblies for smaller systems may not include a mixing valve.

Dip Tube: Where it goes, Dip tube detail



The Check Valve is Factory pre-tightened, **DO NOT TIGHTEN MORE.** Place Arrow down.

Assemble as shown wrapping all loose threaded fittings with 6 turns of Teflon tape and thoroughly tighten.

4 Port Top Connect:

This assembly goes on the separate Solar cold feed and Solar hot return as shown.

The 2 remaining ports are standard cold and hot ports.

Silver and Gold systems include a Tempering Valve, please see next page.

Platinum systems will include the MVT2 Presoldered Tempering valve assembly which is easily connected to these ports.

The 4 Port solar assembly may be presoldered using copper fittings but looks similar and has the same function.

IMPORTANT: Charging the Open Loop Skyline3:

- Close the collector Hot Return Line isolation ball valve (bottom left).
- Connect a hose to the collector Hot Return hose bib to go to a pail or outside.
- **Open the Cold Feed ball valve and let water blast through the solar loop and out the Hot Return "Purge" hose bib until the solar loop is completely clear of air.**
- Close the hose bib, place a cap on it (be sure a cap is on both solar loop hose bibs).
- Open the hot return line isolation ball valve.
- Before finishing insulating the lines, pressurize the solar loop with water and thoroughly test for leaks. **Running a pump dry voids its Warranty.**

SKYLINE3 OG-300 Required Mixing Valve (Note: mixing valve only is included with Silver and Gold system 3. A complete pre-soldered assembly is included with the Platinum System.



A mixing valve is designed to prevent dangerously high temperatures by automatically allowing cold water to mix into the hot water is Required for SRCC OG-300.

Before insulating the lines, pressurize the solar loop with water and thoroughly test for leaks.

Mixing Valve Installation Only the mixing valve is supplied with the Silver or Gold kit unless option MVT2 is ordered. The picture above is of the MVT2 (standard on Platinum) and is supplied for illustration

NOTE: There are many ways to install the mixing valve as long as the ports are correct.

IMPORTANT WARNING: TO AVOID DAMAGE, ALWAYS REMOVE THE INNER PARTS TO THE MIXING VALVE BEFORE SOLDERING.

Mount the sheet titled "Important Warnings and Instructions" onto the front of the tank, Cut out, peel the backing off, and place the supplied labels with their corresponding components.

Before insulating the lines, pressurize the solar loop with water and thoroughly test for leaks.

Installing and Connecting the PV Panel to the Pump

10.0.

Photovoltaic (PV) panel: Place the PV panel on the same plane as the collector. If you have a tilt kit you may need to fabricate a tilt assembly for the PV panel.

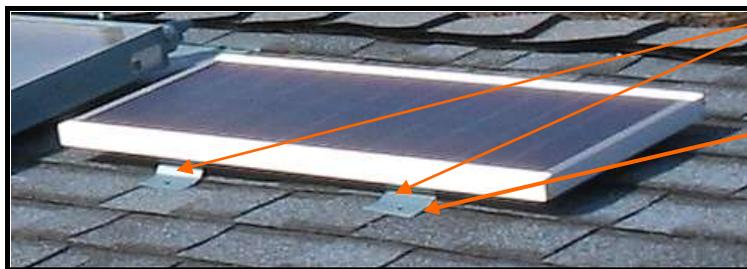
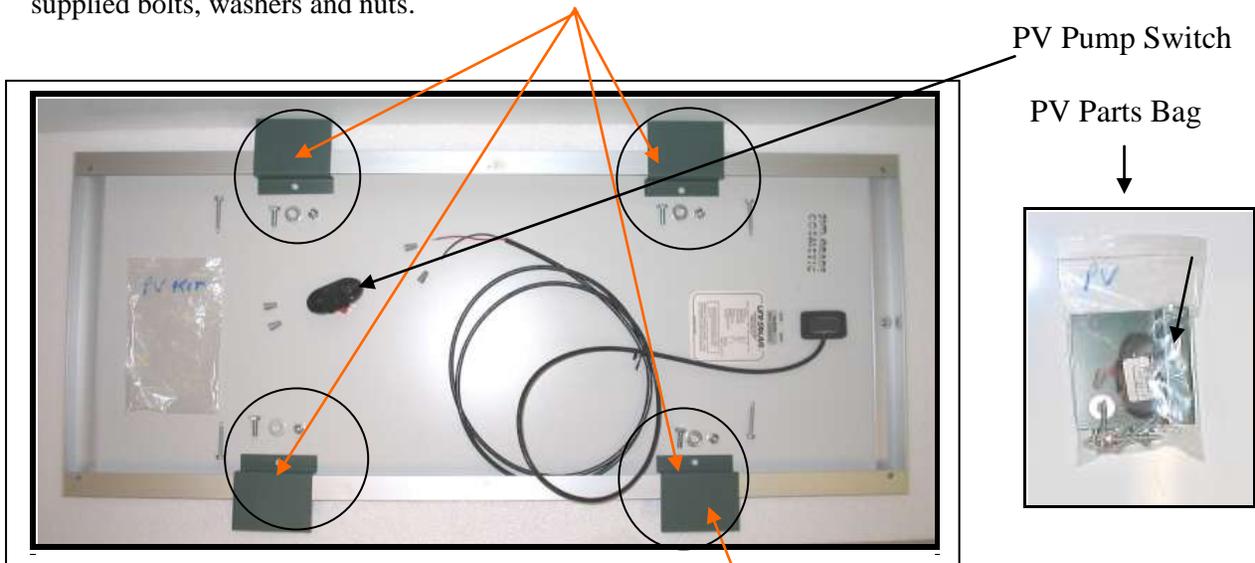
Attach the PV panel to the brackets with the supplied nuts and as shown.

Screw brackets to roof with supplied (Gold and Platinum kits only) long Tec Screws.

Seal the roof penetrations with a quality sealant.

Wire nuts (Gold and Platinum kits only) are supplied to connect the PV wire to the supplied wire, which then goes to the switch. We recommend going through the switch, breaking one wire for the switch and going out about 6" so the PV wire can be connected to the Pump wire with wire nuts. This way the Pump is easier to disconnect and service.

The PV brackets are bolted to the PV panel through existing holes in the frame of the PV panel with the supplied bolts, washers and nuts.



Long Tec Screws, go through the PV bracket and into Roof.

Be sure to put a dab of calk under the bracket where the Tec screw will go through the roof.



Gold or Platinum Tilt Kits Include a special PV to Collector Mounting System as shown.



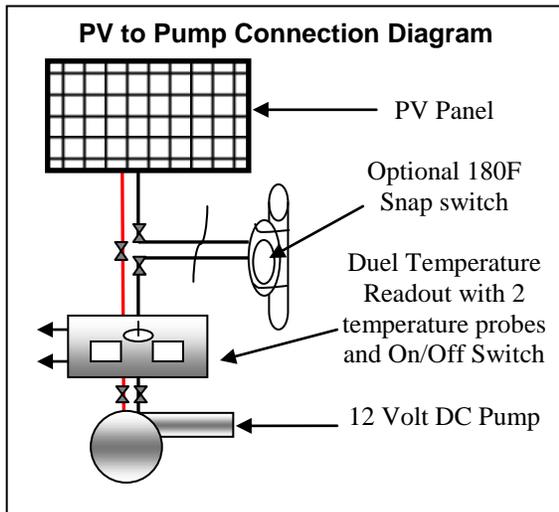
Skyline3 Silver Temperature Readout and Optional 180 F High Temperature Limit Switch Detail:

(see second page below for Gold and Platinum Differential Controller)

PV Wire: DO NOT ALLOW THE PV WIRE TO TOUCH THE PIPE! IT WILL MELT AND SHORT OUT! Drill a small hole under the panel, run the PV wire most of the way through it, seal with calk (lifting a shingle a little before drilling can help) and put PV panel in place over it.

Pump Connections: The PV panel wire is simply attached to a 14 to 18 gauge wire using wire nuts. It is then attached to one of the Temperature Readout Box switch wires, and the other wire is connected to the 12 Volt pump using wire nuts. Simply connect the PV wire (always red + to red +) to one lead and the other lead to the pump.

Tape one of the temperature probes to the hot line from the collector and the other to the collector feed line.

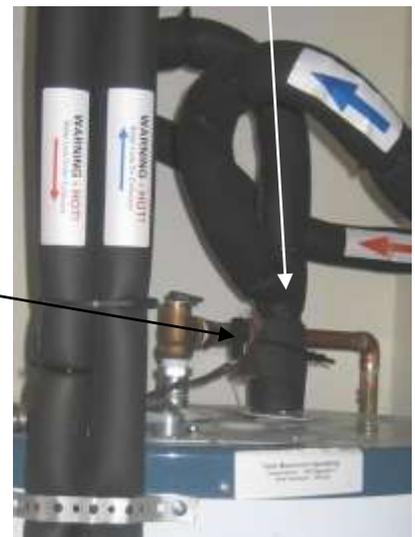
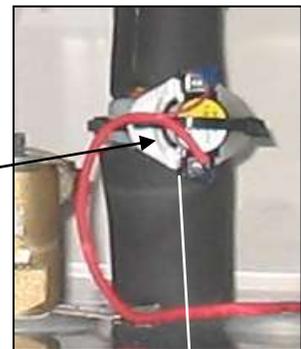


Batteries should last 2 – 3 years, a spare set of batteries is included in the box. Pull tape strip off the bottom of the box and tape to the top of the tank.

OPTIONAL 180F High Limit Switch: Using 2 long wire ties, connect the 180 F temperature limit switch to the cold line out of the solar tank as shown.

Be sure the flat back side of the switch completely contacts the metal pipe or union. After the switch or switch box, break one of the wires to the pump, attach and run a wire set to the normally closed limit switch and connect to both sides of it.

This circuit running through the high limit switch will break the current from the PV panel to the pump when temperatures exceed 180 F and will turn the pump back on when cold water is used or the switch gets below 140 F. For best effectiveness, completely cover the snap switch with insulation as shown in the picture to the right.



Gold and Platinum - Eagle2, PV Powered Differential Controller

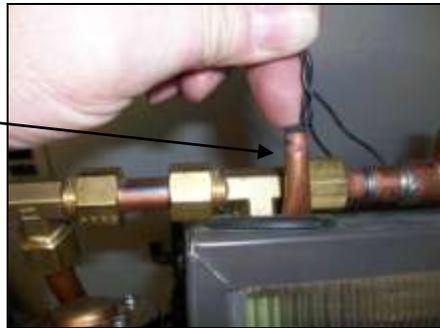
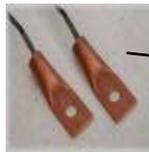
See recirculation freeze protection details on second page

What it does: A differential controller electronically senses temperature differences using 2, 10K thermistors (sensors), it is not a thermostat. Whenever the collector is 12 degrees F or more hotter than the temperature in the bottom of the tank, the controller turns on the pump. When the difference gets to 4 degrees F or less, it turns the pump off. (The differential On is adjustable)

Features: - PV POWERED from 0 VDC to 22 VDC with SMART power management at very low PV power levels. "A must" for soft PUMP starts and smooth controller operation. - Large easy-to-read 40 character (20x2) backlit LCD display showing every parameter measured and controlled by the microprocessor. - Two industrial 400°F (204°C) rated 10 K thermistors with +/- 1°F accuracy are included. - Two auxiliary thermistor inputs for optional sensors that can be located up to 1000' away. - Selectable overrides for low temperature shut down or freeze protection modes for safe operation. - adjustable High temperature limit and open loop system freeze protection.

Installation involves installing 2, sensors from the SENSORS block, one set from COL to a location just inside the inside the top collector and the other set, STO, at the bottom of the tank against the wall of the storage tank as shown. The PV panel will be connected to the PV + and - with the PV + being a common with the Pump + and the Pump negative connected to the SS Relay (SS RLY). EG = Earth Ground.

Set RELAY to AUTO



All Sensor wires are 2 wire with no Positive or Negative.

See Instructions that come with the Eagle 2.

PV + and Pump + are common to each other

SS Relay (SS Rly) Switches pump on when the collector is ~ 12 degrees F higher than the temperature in the bottom of the tank and off when the difference is 4 degrees F

Set Differential ON to 12 degrees F

Set Hi Limit to 180 F

PV Panel

12 Volt Pump

Relay Switch / 2 wire COL and STO Sensor Block

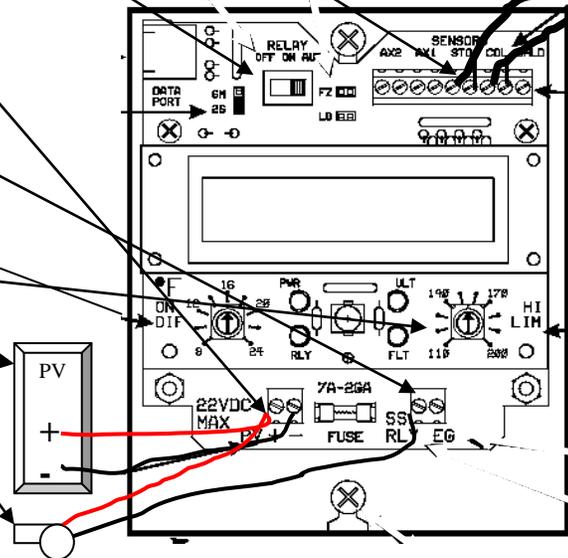
IMPORTANT NOTES:

Use shielded wire for the sensors (2 wires shown as one) and 18 gauge or thicker wire for the PV panel.

If using the two Auxiliary, (AUX,) sensors, we suggest that AUX 1 be clamped or taped to the return to collector copper tube ~ 2 feet above the pump so that a heat exchanger temperature difference can be observed and AUX 2 is to be clamped or taped to the base of the hot out of the storage tank so actual tank temperature can be measured.

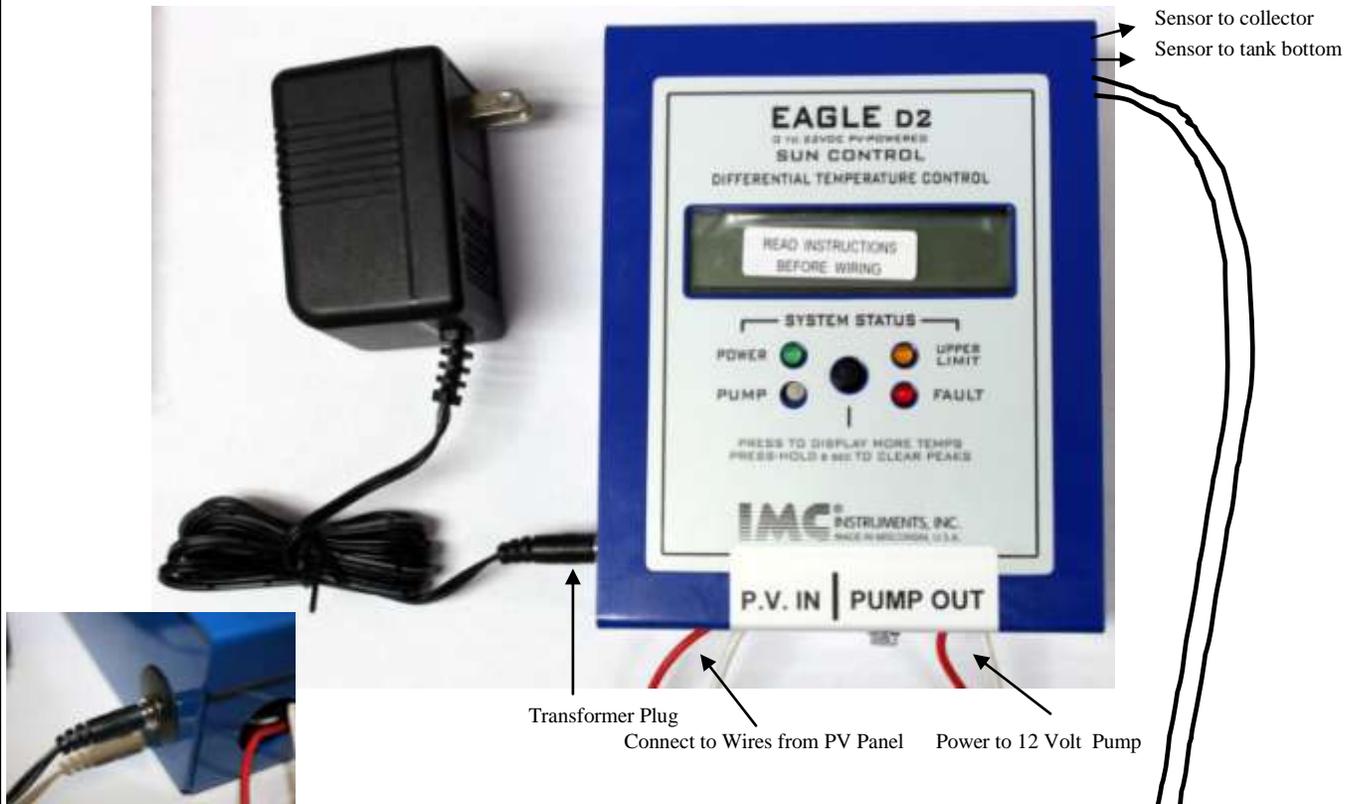
Sensors can be clamped using small Stainless Steel Clamps or taped to the lines using electrical tape.

To ground PV panel, connect green wire to the PV panel frame and the other end to EG (by Relay).



12 Volt Eagle 2 with Transformer Powered Recirculation Freeze Protection

Operation: When there is a Freeze threat, any temperatures expected below 385 F, plug in the transformer to activate the recirculation freeze protection function of the controller. Note the Transformer can be left plugged in but defeats the PV Power when plugged in. The PV panel and transformer have blocking diodes installed in the controller to protect against reverse flow. NOTE: **All Sensor wires are 2 wire with no Positive or Negative.**



OPTIONAL:

Aux 2 sensor is clamped or taped to the top of tank hot out for a solar tank hot water reading.



Aux 1 sensor is clamped or taped to the collector return copper tube 2 feet above the pump so that the heat exchanger temperature difference can be observed.



NOTE: If the transformer line is not long enough to connect to an outlet, because it is low voltage, it can be extended using extra wire and wire nuts.

ACR 5/18/09

QUESTIONS AND ANSWERS:

HOW DO I GET THE MOST EFFICIENCY FROM MY SOLAR WATER HEATER?

As a standard electric water heater usually has two elements, having an electrician disconnect the lower element will increase the efficiency of the solar system. This is because of what is known as “The First Law of Solar”, which is “Keep It Cool”. In other words, the lower the temperature a collector can work at, the greater its efficiency and the more energy it can deliver.

Street water is usually 55 to 60 degrees F but an element at the bottom of the tank will heat this water electrically to at least 110 degrees F nearing the collector must do its job starting at 110 degrees F rather than 55 or 60 degrees F. It is easy to see that more electricity will be used. When disconnecting the lower element it is important to be aware that you will have less continuous supply of water on cloudy days because only the upper element is heating the water. By “staging” the use of water (not having two showers going at once, etc.), the element has time to “recover” the water temperature on cloudy days, so this problem is easily overcome.

Another easy method to increase storage efficiency is to have a 220-volt timer installed by an electrician. It will activate the element for 3 hours in the early morning (say from 5AM to 8AM) for showers etc. and on again in the early evening (say from 4PM to 10PM) for evening use if solar gain hasn't been good that day. This greatly increases the solar efficiency by not allowing the element to come on during hours of solar gain as well as keeping it off during non-use nighttime hours. Ideally, it is most efficient to completely turn off the electricity in sunny weather.

WHAT ABOUT FREEZE PROTECTION?

All open loop system (street pressurized water in the collector) collectors, components and lines, whether they include freeze protection devices or not, are not covered for freeze damage and their solar loop should be fully drained in hard freeze conditions.

Open loop (collector continually open to street pressure water), serpentine copper absorber collectors with “Thermal Freeze Valves” are generally considered to be protected in light and very infrequent (1 to 4 times per year) freeze conditions for temperatures as low as 30 degrees F.

Serpentine copper absorber collectors with “Thermal Freeze Valves” and Recirculation freeze protection are generally considered to be protected in light and infrequent (4 to 12 times per year) freeze conditions for temperatures as low as 20 degrees F as long as 110v power remains on.

The “serpentine” absorber in a “Skyline” horizontal mount collectors is less likely to freeze than a “parallel flow” absorber with multiple risers. This is because water flows through only one tube in a serpentine absorber unlike a parallel flow absorber where the flow could be unequal to non-existent in some of the tubes.

An FP 45 “Thermal Freeze Valve” starts to open at about 45 degrees F allowing a small amount of water to flow out on the roof thus causing water to flow up from the bottom of the storage tank, through the absorber, and out onto the roof as long as temperatures remain low.

A “Thermal Freeze Valves” including Recirculation freeze protection system also causes water to flow out onto the roof as above but in addition causes the pump to continuously circulate water at a greater rate of flow in the entire solar loop from the bottom of the tank and back to the lower part of the tank as long as the power is on. Naturally the lower part of the tank can get very cold in the process. Having the element on gives further protection in freezing temperatures.

If unusual freeze conditions are predicted, it is recommended that the solar the pump turned off, solar loop isolation valves be closed, the solar hose bibs opened and fully drained into a bucket. After this, connect a short section of laundry hose to the “hot return line” hose bib and blow into it until all residual water in the absorber is out and air flows freely out the “cool feed line” hose bib. See Installation Manual as well as Operation and Maintenance Manual for further details.

WHAT ABOUT HIGH TEMPERATURES?

The Skyline collector will not be damaged by stagnation in ambient temperatures as high as 120 F.



This product certified by
Solar Rating and Certification
Corporation
c/o FSEC, 1679 Clearlake Road
Cocoa, FL 32922

SRCC Document OG-300
Conformance to HUD UM 100

ACR Solar
International
5840 Gibbons Dr.
Carmichael, CA 95608

Model No: Fireball 2001
Gross Area:
1,897 m² (20,10 ft²)
Serial Number:

Mildly Cloudy Day
Rating in Category C

12 MJ/day
11 Mbtu/day

SOLAR COLLECTOR CERTIFICATION

FLORIDA SOLAR ENERGY CENTER
1679 Clearlake Road
Cocoa, FL 32922-5703



FSEC 00030

MANUFACTURED BY:

ACR Solar International Corp.
5840 Gibbons Dr., Suite G
Carmichael, California 95608

MODEL #

Fireball 2001

SERIAL #

has been tested for thermal performance and meets the minimum
standards established by the Florida Solar Energy Center as
directed by Section 377.705 Florida Statutes.

THERMAL PERFORMANCE RATINGS*

Low Temp. (35°C, 95°F)	19,000 kJ/day	18,100 Btu/day
Intermediate Temp. (50°C, 122°F)	15,600 kJ/day	14,800 Btu/day
High Temp. (100°C, 212°F)	7,000 kJ/day	6,600 Btu/day

*Based on an assumed standard day for Florida.

GROSS COLLECTOR AREA: 1,865 m² (20,07 ft²)

COVER PLATE AREA: 1,720 m² (18,52 ft²)

COLLECTOR LENGTH: 3.658 m (12.00 ft)

COLLECTOR WIDTH: 0.510 m (1.67 ft)

COLLECTOR WEIGHT: 17.2 kg (38.0 lb)

FLUID CAPACITY: 1.8 L (0.5 gal)

REC. FLOW RATE: 34 Liquid mL/s (0.5 gpm)

TEST PRESSURE: 1103 kPa gauge (160 psig)

MAX. WIND LOAD: 2394 Pa (50 psf)

THERMAL PERFORMANCE EFFICIENCY (ASHRAE 93-88)

Y INTERCEPT: 60.4

SLOPE: $373 \frac{\text{Watts}}{\text{m}^2 \cdot ^\circ\text{C}}$ $\left(66 \frac{\text{Btu}}{\text{ft}^2 \cdot \text{hr} \cdot ^\circ\text{F}} \right)$

INCIDENT ANGLE MODIFIER, AXIS 1: 0.21 AXIS 2: N/A



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Cocoa, FL 32922

SRCC Document OG-300
Conformance to HUD UM 100

ACR Solar
International
5840 Gibbons Dr.
Carmichael, CA
95608

System Model
200131C50

Solar Energy
Factor

1.4

System Serial
No. _____



This product certified by
Solar Rating and Certification
Corporation
c/o FSEC, 1679 Clearlake Road
Cocoa, FL 32922

SRCC Document OG-300
Conformance to HUD UM 100

ACR Solar
International
5840 Gibbons Dr.
Carmichael, CA
95608

System Model
200132C50

Solar Energy
Factor

2.0

System Serial
No. _____



This product certified by
Solar Rating and Certification
Corporation
c/o FSEC, 1679 Clearlake Road
Cocoa, FL 32922

SRCC Document OG-300
Conformance to HUD UM 100

ACR Solar
International
5840 Gibbons Dr.
Carmichael, CA
95608

System Model
200133C80

Solar Energy
Factor

2.9

System Serial
No. _____