

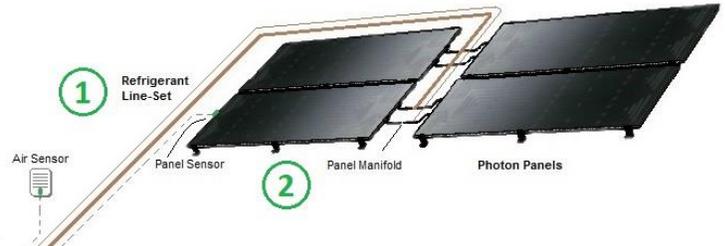
Installer's Guide – 3 Steps Summary

Prepare

- Marshall SunPump, balance of system supplies, and tools checklist. Read Manual.
- Unpack, discuss Safety plan, ladders up, tie-offs secure, vest, helmet and harness on

1. Install Line Set

- Select location layout. Attach backing in Attic between trusses, 4" x 4" x 22.4"
- One length from roof flashing to Mechanical room. Rough-in conduit, or stapled to studs
- Install roof flashing above panels so Line-Set seals better from rain penetration



2. Install Panels

- Use Template or Measure and mark 3 rows of 6 drill locations at 0, 3', 6' | 8', 11', 14'
- Drill 3/16" x 4" deep pilot holes into backing or trusses, sweep debris, then caulk
- Fasten disc Shoes using Drill with 9/16" socket on 5" S/S lag or 1.5" sheathing screws
- Open Panel box, use lid as clean surface to assemble L + U feet tight & square on panels
- Attach Thermistor sensor by liquid line at panel, using screw and 4-5 mm cable clamp
- Hoist panels with L-feet fastened, using harness or rope. No one stands underneath.
- Position panels in horizontal mirror image pairs, liquid line down (smaller 1/4" tube)
- Fasten 1 1/8" hex caps to secure Panels. Snug but not too tight
- Connect flared Tees to 1/4" and 3/8" lines. Alternatively cut off tubes and braze Tees on
- Connect Manifold Distributor with one 1/4" tube to furthest/lowest Tee first, then shorter
- Connect Manifolds to Line-Set supply + return insulated copper pipes

3 KEY ELEMENTS

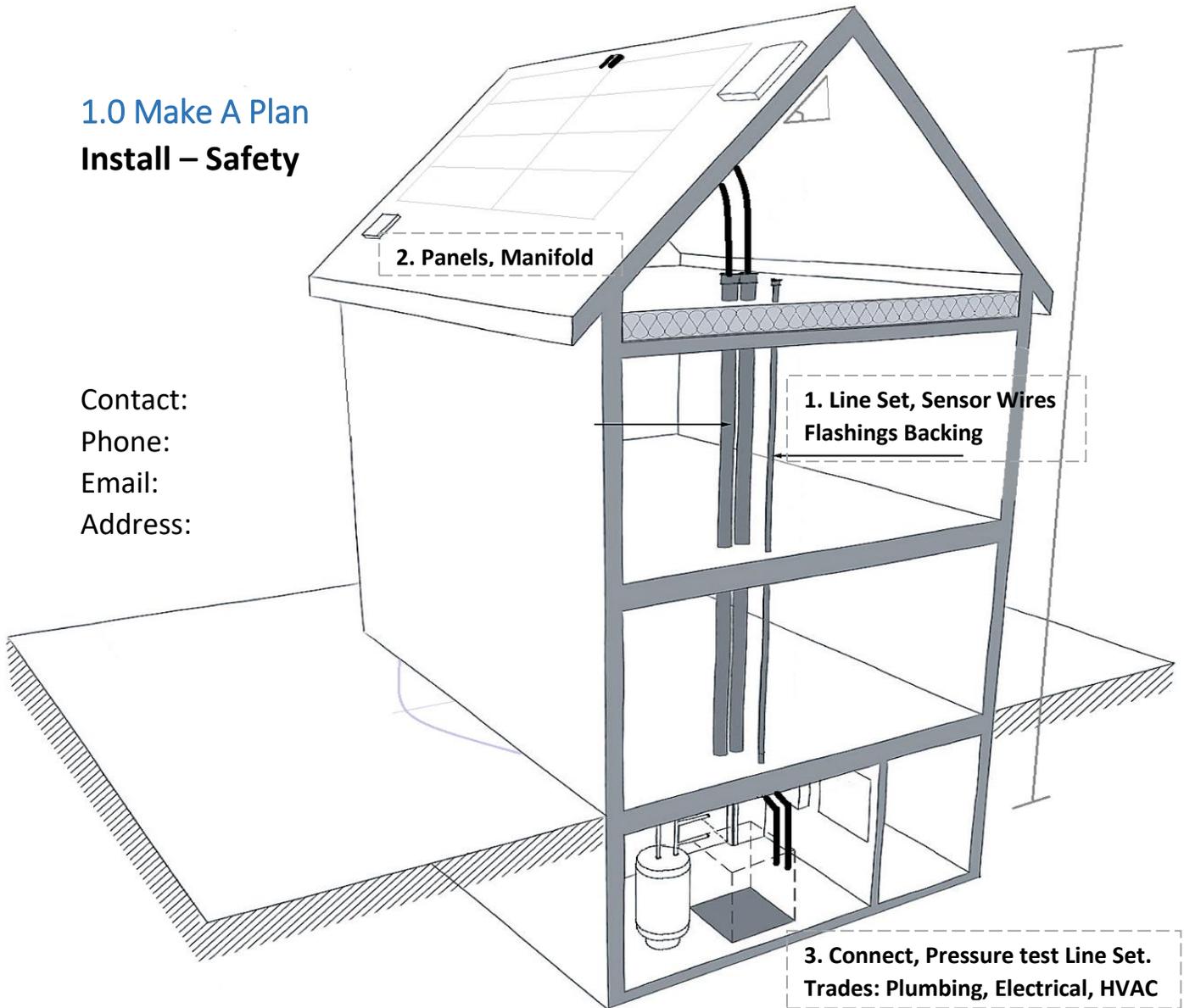
Line Set
Panels
SunPump



3. Install SunPump

- Dolly in, attach seismic straps to wall, place on square drip tray
- Flare Line-Sets, form a Dog-leg bend, attach to Service Valves
- Nitrogen Pressure Test Line-Set, Manifold & Panels 150-200 PSI.
- Inspect carefully for leaks using soap spray. Leave 24 hours.
- Plug in Air and Panel thermistor sensors.
- Attach tank fittings, fill tank with potable water, purge air
- Connect Electrical power.
- HVAC Tech to Evacuate and start SunPump
- Customer gets walk-through on Controller. Service Agreement.

**1.0 Make A Plan
Install – Safety**



Contact:
Phone:
Email:
Address:

Floors	<input type="checkbox"/> 1 <input type="checkbox"/> 2 <input type="checkbox"/> 3 <input type="checkbox"/> Basement	Roof type	<input type="checkbox"/> Asphalt Shingle <input type="checkbox"/> Metal <input type="checkbox"/> Cedar <input type="checkbox"/> Flat <input type="checkbox"/> Other	Orientation	<input type="checkbox"/> South <input type="checkbox"/> E/W <input type="checkbox"/> Other:
Line Rise		Roof pitch	<input type="checkbox"/> Low <input type="checkbox"/> Med. <input type="checkbox"/> High <input type="checkbox"/> Tie-Offs <input type="checkbox"/> Hi Risk	New	<input type="checkbox"/> Yes <input type="checkbox"/> Retrofit
Line Run		Attic Space	<input type="checkbox"/> Yes <input type="checkbox"/> No	Distribution	<input type="checkbox"/> Water <input type="checkbox"/> Air

Fall Arrest - Safety plan: Any installed Tie-offs?

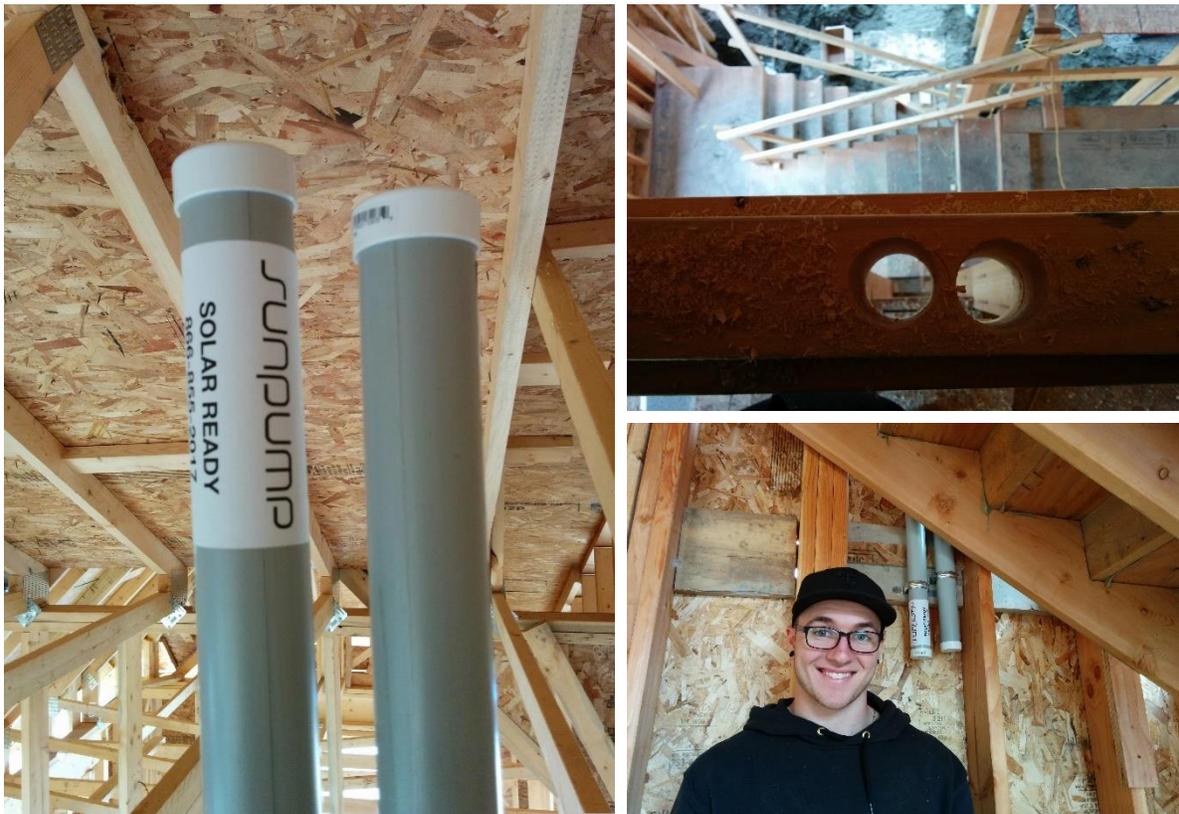
P.Eng sealed roof drawing Code? Backing?

Heating Permit: Heat Loss Calc? Hydronic Plan?

1.1 Install 2" Conduits – New Construction

In new construction a single insulated Line Set can be fastened to interior studs from the Mechanical room into the Attic, with enough length to go through a roof flashing above the Panel location. The copper tubes must be in one continuous length. Insulation should be 3/8" wall to keep a 3/4" tube to 1 1/2" total diameter. Do not make any joints within a wall space, any potential leak at a joint must be in a serviceable space, like the Attic or Mechanical room. Best time is after the roof sheathing is done.

Alternatively, a pair of 2" rigid PVC vacuum pipes can be installed to contain the Line Set. The conduit must be in a straight line; it is not possible to pull a Line Set or thick wire around a bend. Do not use any elbows. If a bend is the last resort, it should be made by heating a two feet of PVC in a 200 F. oven, or hair-dryer like tool, to make a gentle sweep bend. Built Green Points are available for Solar Ready.



Solar Ready Conduit are shown above. On the right, the conduits are capped and marked to be found above Attic insulation. Right-top shows the 2 1/4" holes drilled through a top double wall plate, staying in the center. Right-bottom shows the capped conduit inside the Mechanical room close to the SunPump.

A professional touch is to cleanly finish the entry into the Mechanical room using a 4" x 4" double gang open box, recessed to accommodate drywall. Shown right is an Arlington CE2 Low-voltage cable plate (Walmart) to make it neat. Air seal using an exterior wall box plastic liner, some sealing tape, and foam for the framing holes.



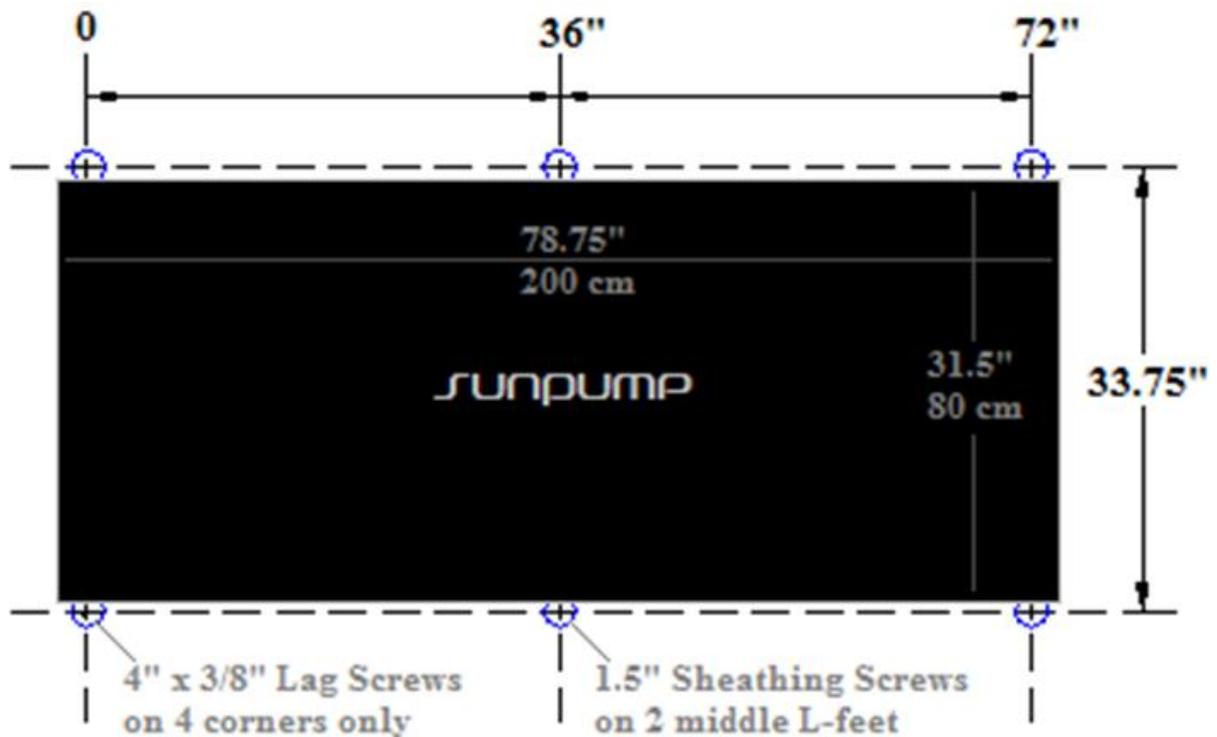
1.2 Roof Backing - Optional

You can ask the General Contractor to have his Framers add "4 x 4" backing between the Trusses to improve fastening the Panels. (It may be Code required along with P.Eng sealed drawings). Or offer to do it for an extra ½ day labor and materials. Most Roof trusses are spaced 24" apart. Prepare the blocking using a cut-off saw at your shop, a fraction under 22.5", try 22 3/8". Each row of a Left and Right Panel is 14 feet wide and 33 ¾" deep; you need 8 blocking pieces per row, times three rows for 4 Panels (Top, Middle, and Bottom), for a total of 24 blocks and 48 steel angle brackets. Keep top row 32" below ridge to satisfy some Fire Codes.

To get started on marking, drill one 3/16" pilot hole from the Attic – through the 4" x 4" blocking to reveal the hole on the roof side. The remaining 17 holes can be marked once you see one corner.



Tip: an old Gym or Hockey bag is priceless for getting the blocks up a ladder and into the Attic. A LED head lamp, protective goggles, and face mask are needed if the Attic is insulated and has no light.



Above are Panels dimensions for mounting hole centers with 1 1/8" offsets - using SunPump L-Foot Kits.

1.3 Run Line Sets

A single length of insulated copper Line Set is run from the roof flashing (A/C U-C at right), to the SunPump location. Only use ACR soft Copper for R410a with minimum wall thickness of 0.8mm (1/4"-1/2"), and 1.0mm (5/8"-3/4" +). Estimate the length and buy from a local HVAC supplier to match the refrigeration valve sizes on the SunPump. We can order 100 foot and 33 foot rolls. Keep the maximum vertical distance under 35 feet, and the total distance under 50-70 feet for the line set. Run AWG22 wire for Air and Panel Sensors. Solder connections or use shop prepared JST Crimp parts to make your own 40-60' extension wire sets. Join wire inside the Attic, avoid roof top joints because of weather creates resistance over time.



TIP the Preferred path is down into an attic space and then down an uninsulated interior wall. An alternative can be a closet corner away from shelves, with a Slim Duct cover to go over the Line Set. An exterior method is to go down the truss and then drop down through the soffit cover and down the wall to reach the SunPump, again using Slim Duct parts to cover the Line Set with the appearance like a downspout. Experience and specialized tools to snake the path can make this task go better. For appearance avoid white insulation on dark roofs, it stands out too much, or cover it.



Nominal Capacity	Panels	Liquid/Gas O.D. Tube ACR R410a wall $\geq 0.8 + 1.0\text{mm}$
5 kW/18,000 BTU	3	1/4" + 1/2"
7 kW/24,000 BTU	4	3/8" + 5/8"
10 kW/36,000 BTU	6	3/8" + 5/8"
14 kW/48,000 BTU	8	1/2" + 3/4"

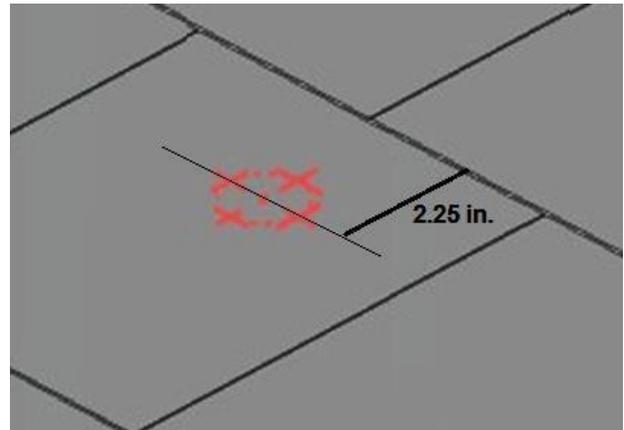


2.1 Marking The Pilot Holes

In this Guide we assume a 4 Panel install in a standard 2 row x 2 column group for example, there are 3 rows of 6 mounting feet for a total of 18. 6 Panels adds one more row of U-Foot for a total of 24, and 8 panels is another row for a total of 30 mounting kits.

Step 1: Mark the Shoe locations. If you are only installing this one SunPump system you can use a tape measure and chalk line to mark the pilot hole locations using a fine-point and bright marker. Do not use a big piece of chalk, it is too difficult marking accurate spots. An alternative is small finishing nails. Start from the corner drilled from the Attic, "0" and work across horizontally at 3', 6', then 8', 11', and 14'. Move vertically down 33 ¾" to mark the next row, and the one(s) after that.

TIP: If you are alone on the roof, Locking pliers can clamp you tape or chalk line at 2.25 inches below the shingle bottom edge. Try a picture-hanger nailed to a wood ruler to hook a tape measure.



Step 2: Drill the Pilot Holes. Use a 3/16" x 6" drill bit with a depth stop at 4" and carefully. Clean sawdust, and fill hole with Silicon Sealant.

Consider making a template if you want speed and accuracy on the roof. Lightweight 1" x ¼" wood like a 1 Meter ruler works well. Best would be 2 / 7' horizontal pieces, 2 / 6' vertical pieces, and 1 / 8' diagonal piece can be riveted together on the corners, squared up by the diagonal, and used to drill 9 quick holes.

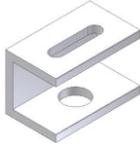


Step 3: Install Aluminum Shoes. to roof using the Stainless Steel 4" x 5/16" lag screws. You will feel through the drill when each screw is in the 4" x 4" backing. Hitting the center of each Truss is unlikely, there is little room for error. A second option is to use four # 12 x 1.5" S/S screws on the Shoe and into the roof plywood or particle board sheathing. The mid-Panel Shoe is at 3 feet where there is not a Truss, so either there is backing at that minimum middle hole, or else use the 4 short screws. If you miss, remedy with scab 2" x 4" from inside the Attic.

3.0 Installing Solar Panels

2.1 Part List for SunPump Shingle Roof L-Foot Kit

Note: Ask for the Installer Guide for Single or Metal roof installs.

	AL L-Foot Included with Shingle Roof Kits K10064-xxx
	AL U-Foot Included with Shingle Roof Kits K10064-xxx (2016 style changed)
	5/16" x 4" Stainless Steel Lag Screw B15015-004
	AL Metal Mount Sealing Washer A20051 & Incl.
	AL Hex Cap 1 1/8" A20066-001 and – BK1
	AL Shoe A20065 & Sealing Washer sShingle roof C10006-001
	AL Flashing A20052-001 and –XXX (Only required for shingle roof)

3.1 Bolt L-Foot to Panels

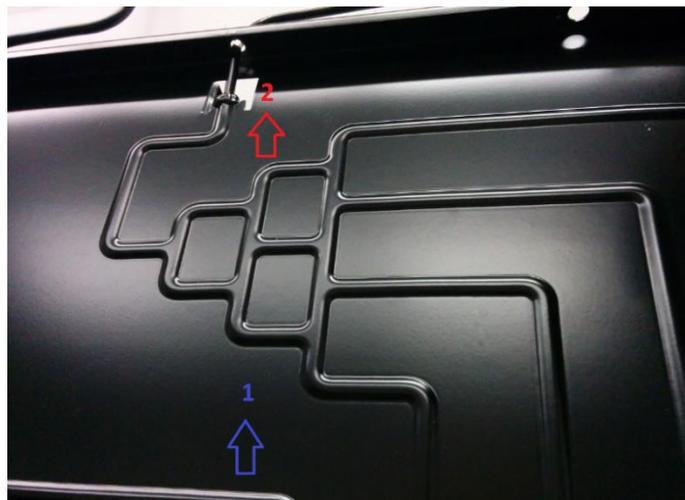
It is smarter and more fun to do most of the Panel work on the ground level to minimize the time on the roof. Ground preparation sets up fastening the Panels to be the easy next step.

Step 1. Bolt L and U-Foot Parts to Panels. Open a box of Panels, and use the lid as a clean work surface. Place each panel face down and fasten each row of L-foot or U-foot brackets square and tight using the S/S 3/8" x 1" bolts in the kit. Use a framing square to get the Foot in the right position.

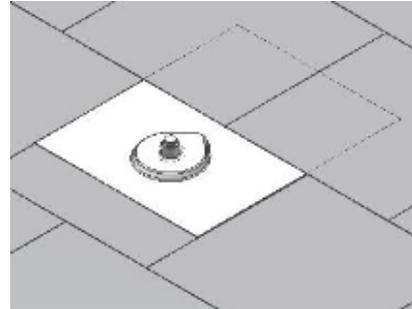


Step 2: Attach the Defrost Sensor to one Panel. The Panel Sensor is a NTC 10k Ohm Resistance Thermistor on AWG22 two wire.

Thermistors measure the change in resistance related to changes in surface temperature, there is no voltage. The ideal location is where frost ebbs on the Panel top surface near the origin of the lower/smaller liquid line. There is a square cut out for the tube connection, (red arrow), which is a pretty good location because it is easy to connect, but it is less sensitive. A little lower and to the side of the branching is best (blue arrow) if you have a clip to screw into the panel (away from any channel), to hold the 5mm Thermistor bulb tight against the Panel. The key considerations are location, contact, accuracy, and ability to service.

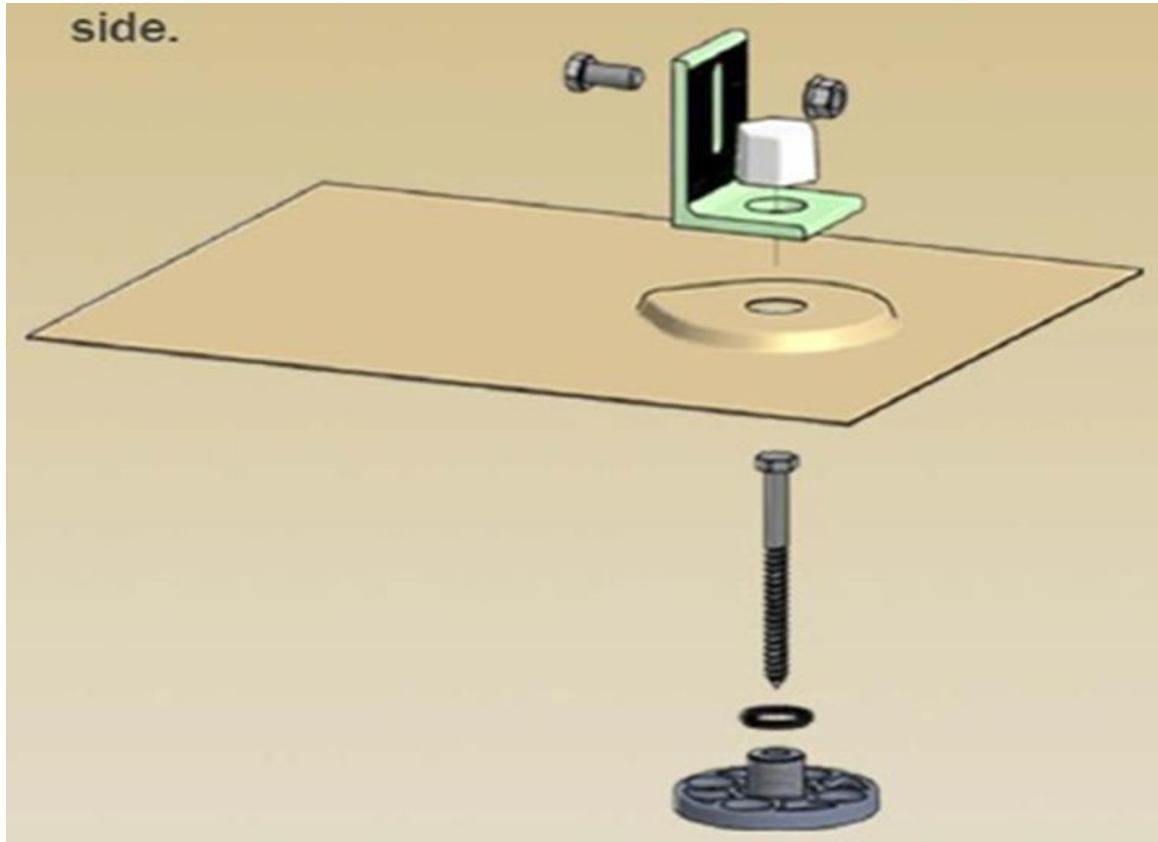


Step 3: Make sure the washer on the threaded shank is positioned correctly. Use roofer bar to lift roof shingle, apply adhesive to shed water away from hole, then slide the flashing under shingle, and insert the flashing on threaded shank as shown.

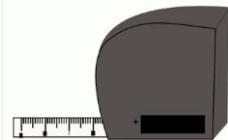
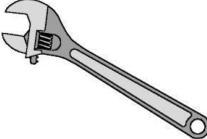


3.2 Attach Panels to the Shoes

Each box of 4 Panels contains two Right and two Left pairs. They are positioned horizontally, aka landscape mode, (not vertical), with connections between panel rows. Use a sling or rope with a Carabiner for quick release to pull Panels from the ground to roof. Secure Panels using a 1 1/16 wrench on the Hex Caps. Fasten remaining Panels to L-Foot using 1/2" ratchet on S/S Bolts. The middle bolt can be a challenge – try tape on the back, or a paper clip over the threads at the front to hold the bolt for a nut.



3.3 Basic Tools and Supplies needed for Installation:

	<p>Tape measure to layout roof installation</p>
	<p>Electric Drill- We strongly recommend against the use of an impact wrench except for the installation of the Lag Screw.</p>
	<p>Drill Bit for lag bolt, 7/32 inch diameter</p>
	<p>Anti-seize compound (Permatex 80071 or equivalent)</p>
	<p>Adjustable Crescent wrench to fit 1 1/16 inch Hex nut</p>
	<p>3/8 Socket wrench with 9/16" deep socket for lag screws and 1/2" deep socket for L-Foot bolts</p>
	<p>Torque Wrench, 3/8 drive, capable of 15 ft lbs for 3/8" L-foot bolts and 25 ft. lbs for lag screw.</p>
	<p>Caulk gun and silicon sealant construction sealant. Other items that can be useful:</p> <ul style="list-style-type: none"> • Roofers marker for marking Shoe locations. • Adaptor for 3/8 inch socket to drill chuck • Torque wrench with 9/16 and 1/2" sockets. (pliers or 1 1/8" for Hexcap)

TIP: A checklist is included for more tools. Wear cargo pants and tool belt with retractable line on tools.

3.4 Installed Panels - Examples



Shingle or Asphalt Shingle Roof – L-Foot Kits



Trapezoid Profile Metal Roof – L-Foot Kits

Notes:

Panels should be 32" or more below the ridge (1 Panel height), to satisfy some Fire Codes for access.

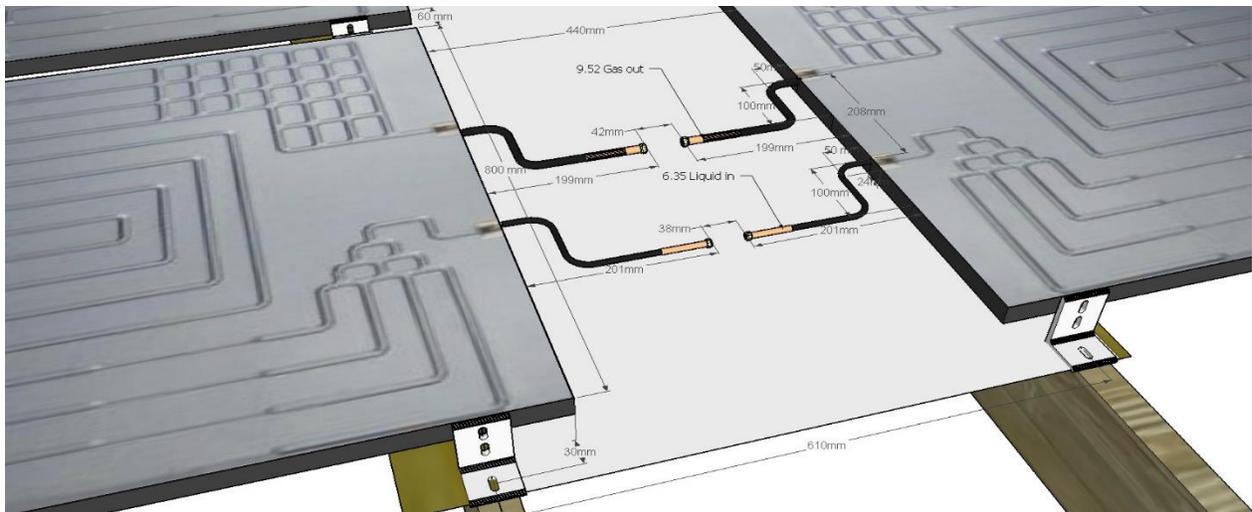
Flashing should be centered above and between Panels – not below like the top picture.

L-Foot kits come in boxes of 50 sets for Installers. Standing Seam Metal roofs order S-5! Mini-Clamps

4.0 Connect Panel Manifolds

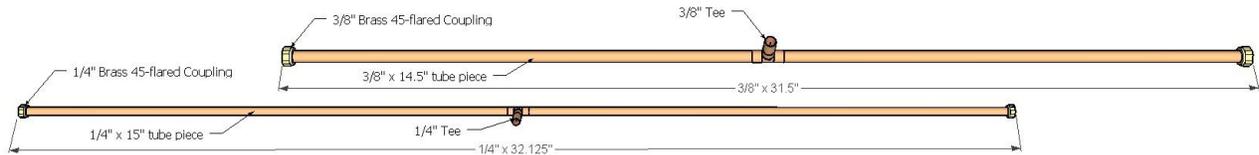
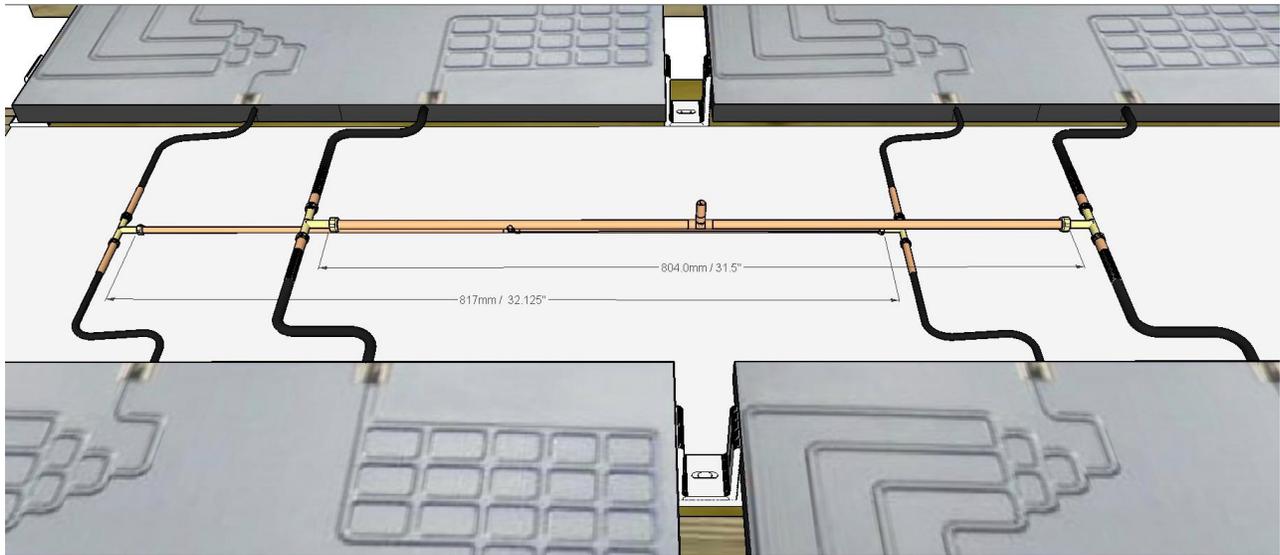
Panels are connected in Parallel with each horizontal Panel receiving about equal share of flow. Series connection is unacceptable. Reverse return has been tried and is OK, however the best practice is to use a Distribution Manifold to get approximately the same liquid flow to each Panel. Most variations are insignificant, flow will always take the path of least resistance, so do not try for perfection. Liquid lines need the attention, Gas lines are forgiving as the gas compresses and balances.

Method A: Pre-Sept-2016. An Array of 4 Panels is connected in between by matching each left and right pair of 1/4" liquid tubes, and 3/8" gas tubes, to a pair of same matching size 45-deg. Flared Tees. In other words, the 4 small tubes and 4 larger tubes are connected by 2 small 1/4" Tees, and 2 larger 3/8" Tees using a torque wrench and open wrench to seal the 45-flared copper pipe to the Tee. This will reduce a total of 8 tubes down to 4 Tees in one Quad. Alternatively, some installs prefer to cut of Flares and Braze



One pre-made Manifold pair or set then reduces each pair of Tees down to one pipe, to achieve equal distribution of fluid branched to the 4 Panels. A 1/4" plus a 3/8" manifold pair is all that is needed to reduce 4 tees down to 2 pipes, to fit through the roof pipe flashing. When there are 2 or 3 groups of 4 Panels in the Array, additional manifolds will reduce the pipes down to one each for liquid and gas. Tube size reduction is 1/8" at downstream branch locations of a Tee. The example at right shows a 1/2" Tee is reduced to 3/8" using insert bushings. Or find reducing Tees.





TIP brazed copper welding has superior strength and leak-prevention than 45-deg. flared, so consider using a portable Oxy-Acetylene kit to pre-fabricate and custom fit manifolds on the roof.



Above is a 2 x 4 Array of 8 Panels for a 14 kW SunPump on a typical asphalt shingle retrofit roof. Notice the scoop shaped pipe flashing in the center for the Line Set, as a good location for fitting the manifolds. Best is flashing location is one row down to allow for the Manifold and shortest equal length tubes.

Method B: Post-August-2016. SunPump can supply 2, 3, and 4 port copper Distributor manifold as ready to install assemblies. SunPump will offer nitrogen brazed manifolds with equal length tubing September 2016.



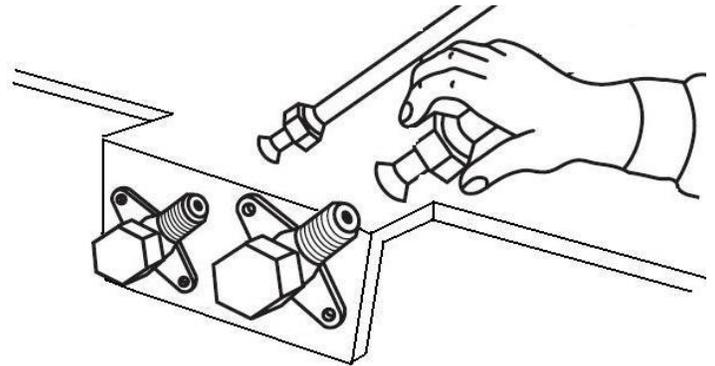
5.0 Connect SunPump

Step 1: Set SunPump on a Drip Tray. Oatey makes a 28" x 30" drip tray for Washing machines. Place on top of optional rubber or anti-vibration mat for thermal and noise reduction. Attach the 1" PVC overflow fitting to the side outlet toward the floor drain.



Secure Line Sets to wall using 2-hole brackets. Do not over-tighten, insulation should not be crushed.

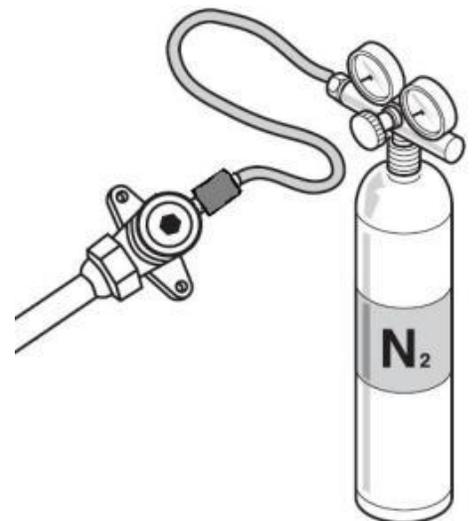
Step 2: Connect Line Set to Service Valves. Form the Line Set from the Mechanical room entrance with a Dog-leg bend for expansion and possible extra length for re-flaring length to the SunPump. Use sweep curves for lines and avoid sharp bends. Use a quality R410a Flaring Tool. Swab a light film of POE oil on the flare to improve the connection. Use a Torque Wrench and drop of Loctite to prevent leaks caused by vibration loosened flare nuts.



5.1 Pressure Test Line Sets

This optional step can be done by a veteran installer with the right tools. First remove the Schrader Valve using a 5/16" valve removing driver to eliminate the one-way flow restriction. Place in a sandwich bag or another dust-free container for reuse. (once it touches anything it should be replaced with a new valve.) Test the Line Set and Manifold connections by attaching a Nitrogen tank to the side branch of the Gas 3-way Service Valve. Set the Regulator to 160 psi (12 Bar). If there are leaks, they must be identified and fixed. Do not exceed 200 PSI.

TIP: Spray the joints with a soapy solution and inspect carefully for bubbles that form from a gas or liquid leak. To find micro-leaks, consider leaving the line pressure on overnight. Mark the gauge with some tape or write down the stable pressure, then close the tank and leave for a day to observe if the pressure drops significantly over 24-hours. Pressure will reduce a small amount due to lower temperature. Schedule the HVAC mechanic after verifying the tubing system does not leak.



5.2 Locate Seismic Strapping

Seismic straps are a Plumbing Code requirement in many Western States and Provinces. While knowing the Regulations and installing the straps is the responsibility of the Plumber, the Installer should know how to get it done and avoid leaving seismic straps too late in the install. Small Mechanical rooms may have to prepare attaching straps to the wall studs before SunPump is filled and connected. The challenge is off-the-shelf kits from Watts or Keeprite are made for round tanks – not square. Like the drip tray, seismic straps are a difficult solution to source the first time.

Locating and fastening to studs before SunPump gets in the way is easier. The recommended custom solution is to use Woven Seismic Strap. It is a black fabric about 1.75" wide with a high tensile strength between 400-440 lbs. You can order a 4-piece kit with fasteners from SunPump. It is installed by folding an end over a metal strap that is screwed into the inside edge (behind the front panel), and again into a wall stud. The two heights are 16-inches and 48-inches from the floor. Attach behind the removable front panel – not in front, and stay below the heat pump compartment.



5.3 Connect SunPump to Water

WARNING: Do not attempt to start SunPump without being water filled and the service valves opened to the Panels. There are safety protections that are not meant to be circumvented.

Step 1: Fill Water Tank. After the square drip tray and anti-vibration mat are in place under SunPump, the Installer can prepare SunPump for water heating. These Plumbing steps might not be in the scope of work for the installer, typically completed by a Plumber, but may fall back to the installer if it has not been clearly defined who is responsible unless it is work that can only be done by a licensed trade (or home owner).

a.) Start by installing a compact 3/4" MIPT Boiler Drain in the bottom port marked Drain. Do this fitting first because it is so close to the drip tray that it may be necessary to tilt SunPump to fit some angled fittings. Use liquid Teflon on the tapered threads, do not overtighten. Add potable water through a hose or pipe. A second temporary Boiler Drain should be added if the install needs to continue before the Plumber arrives. Attach at the top port labelled Hot Water Out to allow the fill to complete and to bleed out air from the top of the tank. Alternatively use a Ball valve, or take PEX pipe down at 45-degrees in a heat trap loop, to the wall and plug. The downward direction avoids thermo-siphon heat loss because heat does not travel down a pipe very far.



b). Attach the Pressure/Temperature relief brass valve to near the top port, either 1 or 2 ports down. It will have a Pressure Relief Valve label.



c). If temporary, use a 3/4" brass plug in the port marked Cold Water In. Alternatively install a permanent elbow like the 3/4" PEX x MIPT at right. Design flow rates are 2.5 GPM per 3.5 kw or 12,000 BTU. A 14 kw will require a 1" pump that provides $14/3.5 = 4 \times 2.5$ GPM = 10 GPM at 10-15 Feet/Head.

5.4 Connect External Air and Panel Temperature Sensors

Your SunPump system comes with two NTC 10k Ohm temperature sensors that need to be installed outdoors and connected by AWG22 2 conductor wire to the small plastic connector on the right side of the indoor heat pump unit shown in green as figure **S2** on page 6 parts list. Their purpose is to assist in Defrost and heating controls by measuring temperature through small changes in resistance that correspond. In new construction the wires can be roughed-in from Mechanical room to roof and soffit overhang areas. Make certain **S1** is installed in the lower tank thermistor well, as shown in red on the parts page 6. If it is in the upper Well, move it to the lower for best results.

The small black or white plastic connector is a **JST** type used in low voltage Electronics and Vehicles. It is like the Molex type that also uses miniature crimped pins, but is smaller. Learn how to undue a connection pair, you must depress a catch. Do not try to pull apart by tugging on the wires, the pins are not hard to damage and then the fix becomes time consuming. Be patient, do not use force.

The Ambient Air sensor (bottom right), should be installed on a shady exterior wall, or alternatively under the roof overhang shown in the picture. Do not locate inside the Attic, on the roof, or in the Sun where the accuracy will be lost.

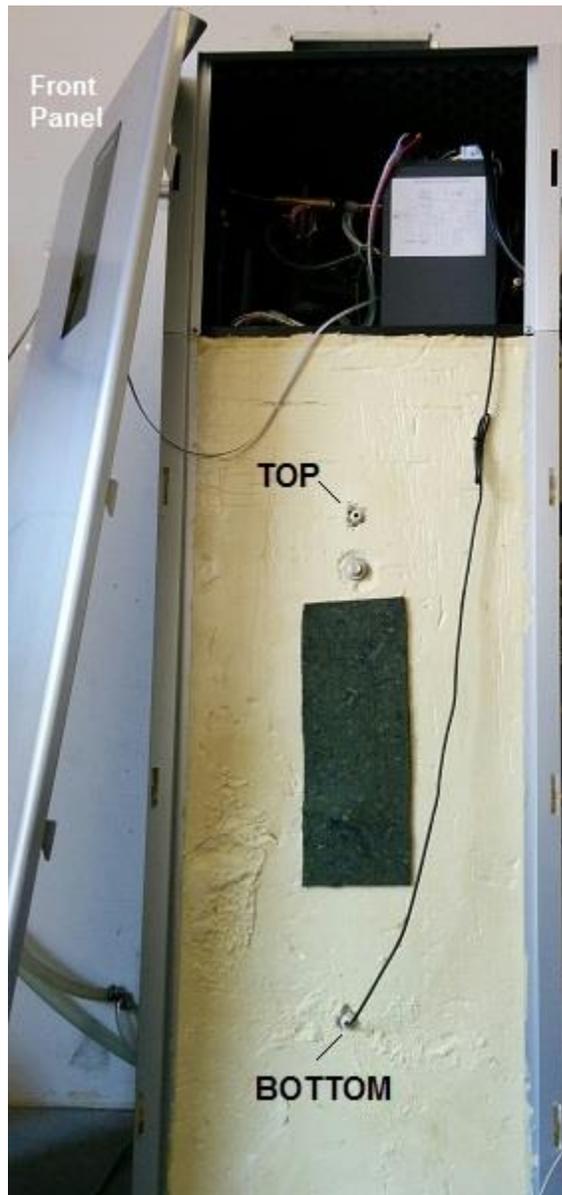
The Panel sensor (right), is fastened securely by a twisted wire strand done with pliers, to a Panel on the smaller ¼" liquid line that is the lower of the two on any Panel. The sensor needs to be as close to the panel as possible, right at the square cut-out is best. The goal is to measure the lower entry to the Panel, where Frost builds up. Do not install on a pipe that is inches away from the Panel because it is less accurate.

Extending the AWG22 gauge wire is simple, but needs to be done with care. Solder the twisted strands and use a shrink wrap to seal joined wires to avoid poor connection aging that will increase resistance and alter the sensor accuracy over time. Installers should consider a JST crimper kit and bulk wire to make various lengths as required. A prepared 50-foot roll with male to female JST ends can plug in to extend sensors.



5.5 Water Temperature Sensor – MOVE to Bottom Well

SP2.3-3.0 2016 models had the sensor in the wrong location at the top, it must be relocated to the bottom well. Verify the correct Bottom location is right to heat the full tank. SP3.1 has corrected the location in 2017.



SP3.0 WATER TANK TEMPERATURE SENSOR LOCATION

Incorrect. If the NTC 10K ohm Thermistor is in the Top well location, the water temperature will be cold below this level. It **MUST** be moved to the Bottom well for full tank heating.

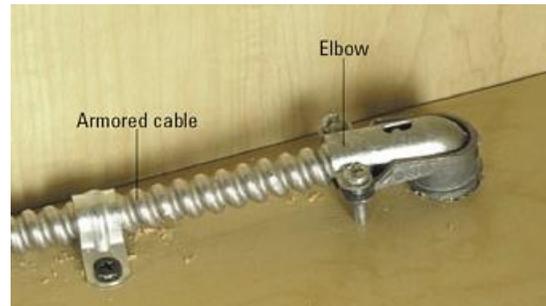
Correct location is the bottom well, as shown. Use thermal paste on Sensor end, and 18-26 gauge 2 wire to extend.

6.0 Connect Electrical Power to SunPump

NOTE: The ETL label on the SunPump shows the specifications for *Input Power* and *Running Current*. If the Manual has a different or conflicting specification value, rely on the silver colored ETL label on the SunPump case as most authoritative value for the build of your model. The Specifications Sheet is second to the label. This Installer Manual is a Guide that covers models that are improved periodically.

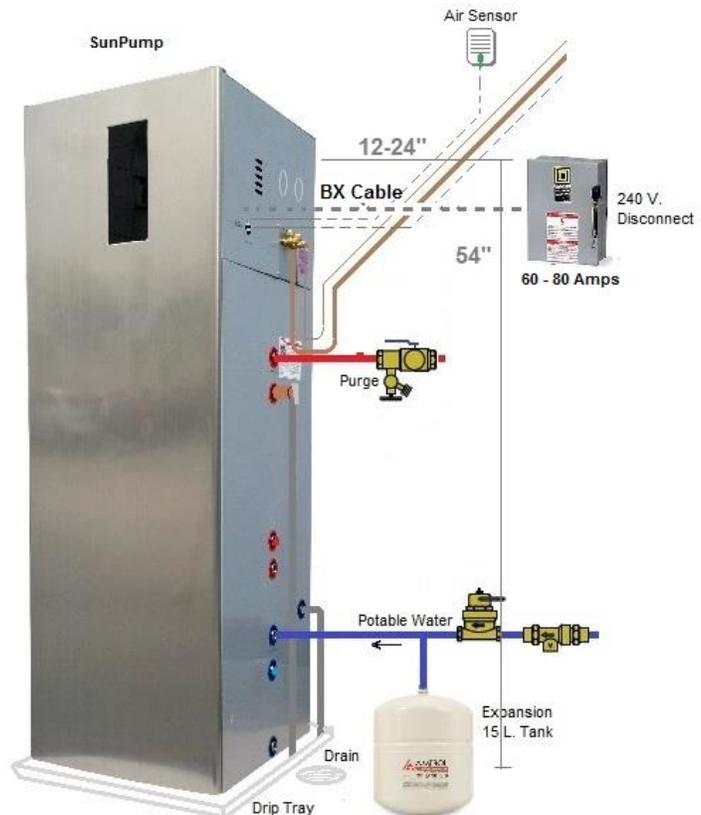
SunPump 3.0 models made in 2016 are standard built for **230 V 60 Hz. 1 phase 2 Conductor wire plus Ground** on all residential units between 3.5 and 14 kW nominal heat capacity. All models require two power connections,

- i) for the Heat Pump, and
 - ii) for the 6 kW electric element backup in the tank.
- Each requires its own breaker.
Power wires should be in metal conduit.



NOTE: All models do not have a Neutral bar or a 4-wire terminal block. To add a 115v component like a pump requires adding a plastic terminal bar strip for the Neutral wire, and using just one leg of power.

Electrical	Refer to local electrical and building codes for wiring and installation requirements				
Compressor	DC Inverter 208/230 single phase. 2 wire (L1, L2, G)				
Rated current	4.6 A	6.8 A	9.2 A	13.2 A	18.4 A
Max. current	8 A	11 A	15 A	19 A	26 A
Heat Pump Breaker/voltage	15 A / 240 V	15 A / 240 V	20 A / 240 V	30 A / 240 V	40 A / 240 V
Elec. Backup Heater	6 kW	6 kW	6 kW	6 kW	6 kW
Elect. Backup Max./Breaker	30 A./40 A	30 A./40 A.	30 A./40 A.	30 A./40 A.	30 A./40 A.

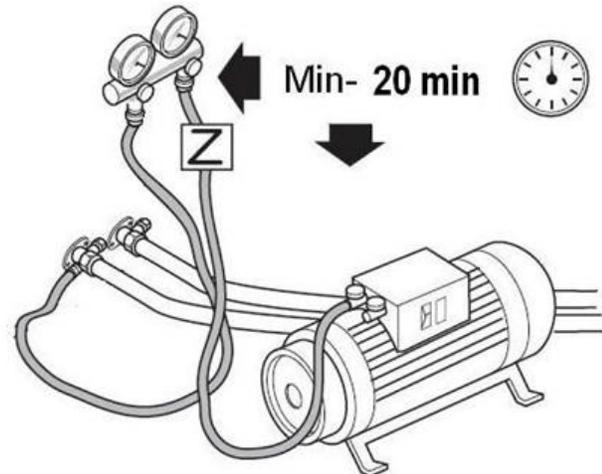


In new construction a 230 V electrical 4" x 4" open box should be located 54-inches above the floor, and about 12-24" to the right of the SunPump right edge. (SunPump is 26" wide). Avoid locating box behind or to the left of SunPump.

7.0 Apply Vacuum

Connect a good quality vacuum pump to the smaller refrigeration valve or low pressure side needle valve, to draw out all the Nitrogen and moisture from inside the tubing for at least 20-minutes to reach under 500 microns.

The gauge should read 0.135 KPa and remain stable for at least 15 minutes, hours later is better. After successful completion of the vacuum process, the valves can be closed and the vacuum hoses removed.



7.1 Access the Refrigerant Charge

The SunPump units are pre-charged for a 33-foot (10 meter) Line Set, and can most often be started without altering the refrigerant amount. Always allow the SunPump to run for at least 20-30 minutes to stabilize before evaluation. The actual pre-charge is recorded on the chrome-colored label on the right side of SP case. The pressure/temperature gauges should show a significant charge, equalized in the 100-200 PSI range – from low to high ambient temperature. (if not, contact us immediately). Do not start up the Heat Pump if there is no pressure on the gauges, it is suspect for a leak.

MODEL	24,000 BTU (7 kW)	36,000 BTU (10 kW)	48,000 BTU (14 kW)
Pre-Charge R410a	63.6 oz. (1800g)	81 oz. (2300 g)	102 oz. (2900 g)
Extra 3 ft. (1 Meter)	1 oz. (30 g)	1.1 oz. (33 g)	1.2 oz. (36 g)

Typical values on a 20 C day, a typical install will see High Pressure in the range of 400-500 PSI at water temps near 50 C, with Low Pressure near the 60-120 PSI range, and a sub-cooling of 5 C (8 F). These are typical and subject to many conditions, mostly ambient (evaporator) and water (condenser) temperature

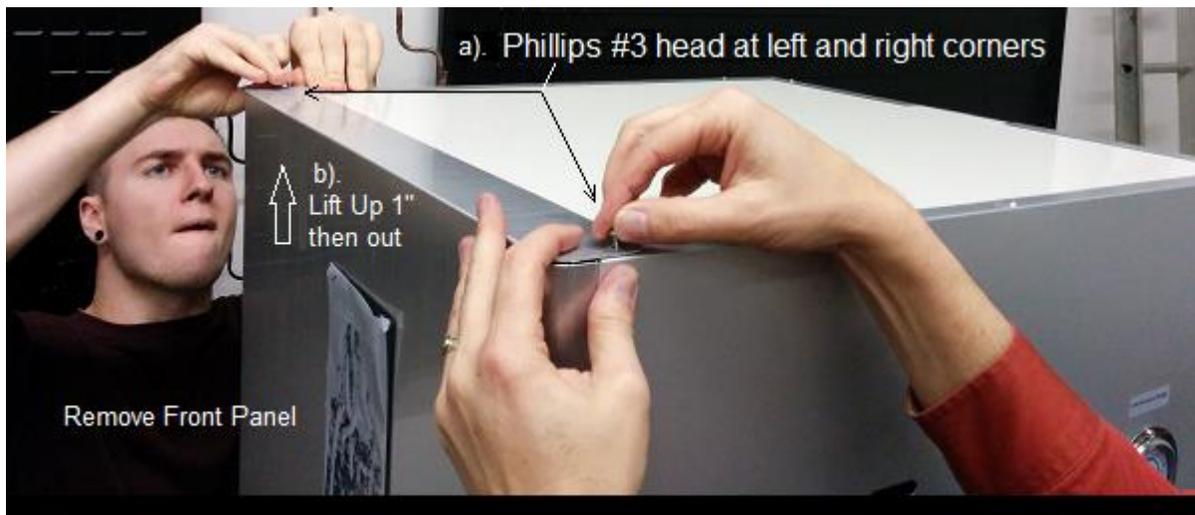
If adding or removing a few ounces of R410a is required, use a weight scale and enter the refrigerant slowly as a liquid. Always **add liquid into the larger low pressure or suction line and always in liquid form.**

The Design low/high pressures for SunPump is 305/609 psi, and the maximum peak pressure shall not exceed 700 psi.



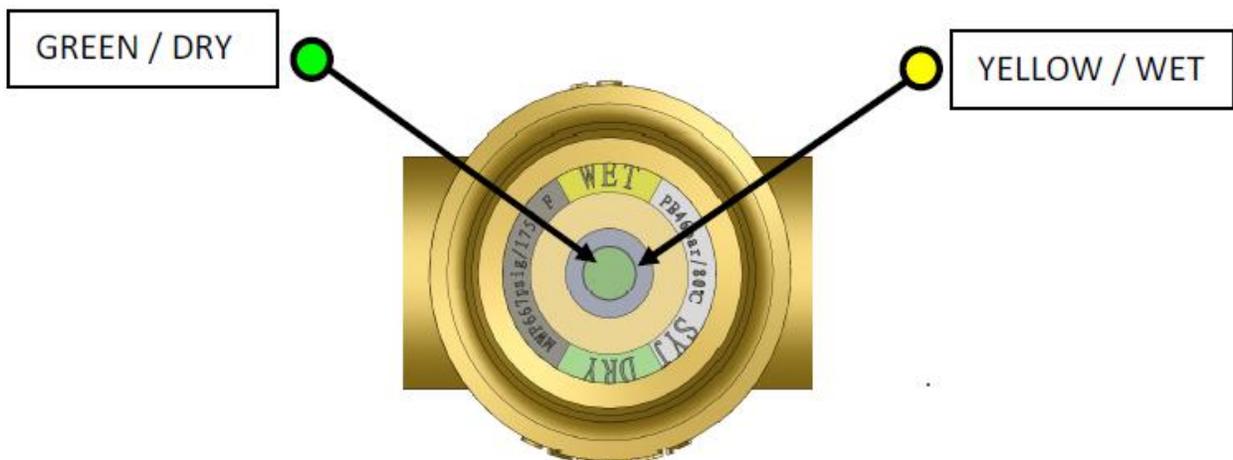
7.2 How to remove front panel

Remove two Phillips screws from the top left and right corner, then lift up 1-inch to free hidden hooks.



7.3 Balance Visually Using Sight Glass

Sight glasses are installed after the filter drier in liquid line of refrigerating systems, in order to observe property changes of the refrigerant (liquid/vapor) and to indicate the moisture level by colors.



Refrigerant	Moisture Content 25°C: PMM		
	Green/Dry	Middle Color	Yellow/Wet
R410A	<75	75~150	>150

7.3 Balance by Sub-Cooling - Superheat

How to Determine Superheat

1. Determine suction pressure close to the compressor.
2. Use the Pressure Temperature Chart to determine saturation temperature at observed suction pressure. (Example: 140 psig = 49° F)
3. Measure the suction line temperature at the approximate location of pressure reading. (Example: 63° F)
4. Subtract the saturation temperature (step 2) from the suction line temperature (step 3). The difference is the amount of superheat. (Example: 63° F - 49° F = 14° of superheat)

$$\begin{array}{r} 63^{\circ} \text{ F} \\ - 49^{\circ} \text{ F} \\ \hline \text{Superheat} = 14^{\circ} \end{array}$$

How to Determine Sub-Cooling

1. Determine liquid pressure close to the condenser coil outlet from the blue Gauge
2. Use the Pressure Temperature Chart to determine saturation temperature at observed liquid pressure. (Example: 432 psig = 122° F)
3. Measure the liquid line temperature at the approximate location of the pressure reading. (Example: 110° F)
4. Subtract the liquid line temperature (step 3) from the saturation temperature (step 2). The difference is the amount of sub-cooling.

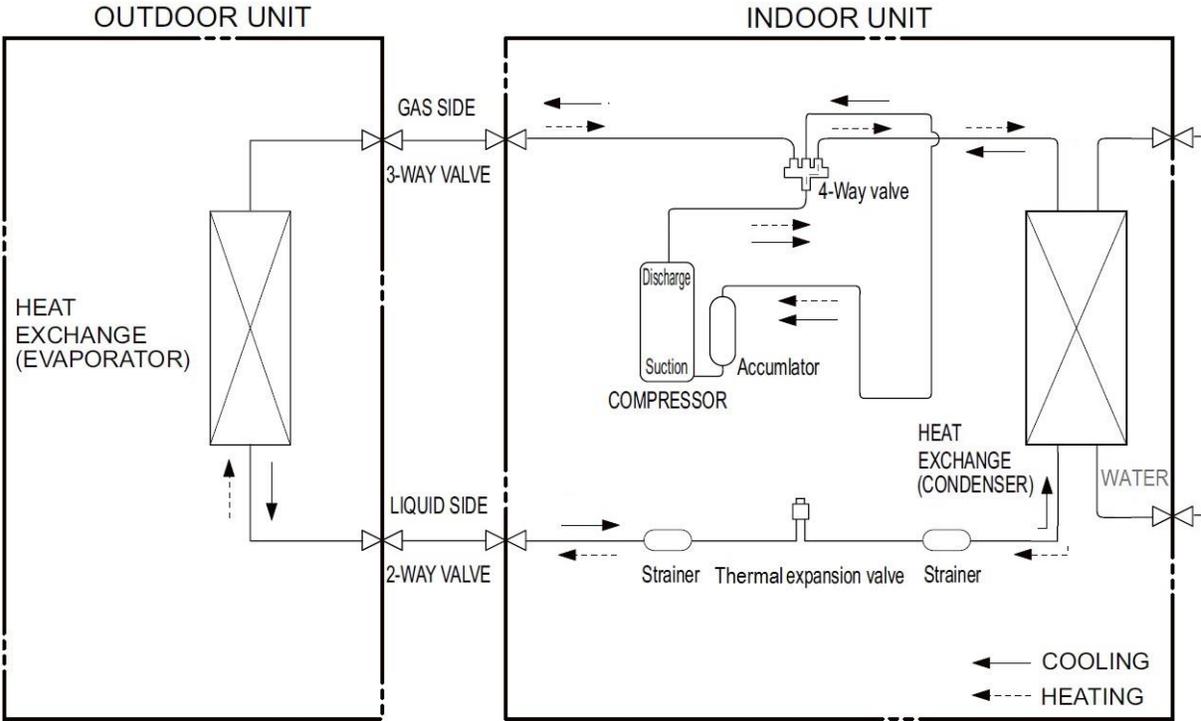
$$\begin{array}{r} 122^{\circ} \text{ F} \\ - 110^{\circ} \text{ F} \\ \hline \text{Sub-Cooling} = 12^{\circ} \end{array}$$

The amount of Sub-Cooling should be within a range of 8-14 F, with 10-12 F. as the Target.

R-410a Example

° F	R-410a psig	° F	R-410a psig	° F	R-410a psig
7	58	41	120	75	220
8	60	43	125	78	230
10	62	45	130	81	240
11	64	47	135	84	250
12	66	49	140	86	260
14	68	51	145	90	275
15	70	53	150	94	290
16	72	55	155	97	305
17	74	56	160	100	320
19	76	58	165	104	335
20	78	60	170	107	350
21	80	62	175	110	365
24	85	63	180	113	380
26	90	65	185	117	400
29	95	66	190	120	420
31	100	68	195	124	440
34	105	70	200	127	460
36	110	71	205	130	480
38	115	73	210	134	500

7.4 System Schematic



8.0 SUNPUMP START-UP REPORT

Please Complete and email: admin@sunpump.solar fax: 1(866) 855-8279

Day		Month		20		New <input type="checkbox"/> or Retrofit: <input type="checkbox"/>
CUSTOMER Name						
Address						
City						
BUILDING total area						
			Ft ² Heated		Ft ² Unconditioned	
Non-Conditioned space						
Crawl space: <input type="checkbox"/> Basement: <input type="checkbox"/> Other: <input type="checkbox"/>						
Roof Surface						
Asphalt Shingles: <input type="checkbox"/> Corrugated Metal <input type="checkbox"/> Standing Seam Metal <input type="checkbox"/>						
Distribution Type						
Radiant <input type="checkbox"/> Forced Air <input type="checkbox"/> other <input type="checkbox"/>						
Backup Heat						
Nat. Gas <input type="checkbox"/> Electric <input type="checkbox"/> Propane <input type="checkbox"/> Wood <input type="checkbox"/> Other <input type="checkbox"/>						
HVAC Company						
Mechanic/Tech name						
Day phone/email						
MODEL of SunPump						
Heat Capacity		kW		SP-3.0 (or ?)		SP-
Pressure in PSIG (or?)		High		psi		Low: psi
Correspond Temperature		Ambient Air:		F.		Water: F.
Current Compressor Amp		amps		normal <input type="checkbox"/> high <input type="checkbox"/>		
Line-Set run distances		Vertical feet			Horizontal feet	
Pressure Test done by:		Refrigeration Tech <input type="checkbox"/>			Installer <input type="checkbox"/>	
R410a Charge change		Add Amount		oz.		Removed oz.
Observations of any type:						
Signature:						
Date received by SunPump						

9.0 REFERENCE CHECK LISTS

1 Plan Documents

Safety Plan Roof Sketch
Work Order - Scope of Work
Heat Loss calculation / Hydronic Plan copy
Solar Exposure - picture
Annual Service Agreement – maintenance contract
Reference binder - User Manual, Installer Manual, Roof Install Manual
Commission Report
Pictures of Before, during, and After. Panels completed. SunPump mechanical

2 Safety Items

Roof safety planning sheet, panel line-set sketch
Fall Arrest safety harness kit, 50-foot rope
Tie-Offs to match roof type. Sell as Permanent roof part?
Ladders with stand-offs to protect gutters, leveling blocks, stakes
Panel lifting sling or rope with quick-release. 2 Pet leashes and ring
Scaffolding, Skyjack Scissor-lift, Genie boom
Tennis ball with 100 feet para-cord and 100 ft safety rope
SunPump Green Hardhat, Work gloves, roof shoes/boots, safety-glasses
Water, snacks, sunglasses, bug spray, sun-lotion, shoe-mud slip-over protectors

3 Panel Install - Roof Tools

Drill - 12V with spare battery, vehicle recharger
Auger 2" bit for line-sets or conduits through wood top plate
Socket adapter for drill, and extensions for 3/8" drive sockets
1/2" and 9/16" open and box wrenches, ratcheting wrench, sockets
1 1/16" socket for Hex Cap, channel-lock pliers
Shingle Pry Bar
Sealant caulking gun
Chalk Marker - fine tip, Chalk Line
Locking Pliers to hold chalk line end
Levels
T-square 48"
Tape measures
Template. 2 horizontal, 2 vertical, 1 diagonal 1" x 1/4" frame
Hole saws. 2 1/4" for 2" conduit, roof flashing
Wire strippers, needle nose pliers

4 Plumbing Tools

PEX crimper 1/2" to 1", PEX cutter
Water bucket with towel for spills
Pipe wrenches, channel lock pliers
Garden/Potable (white), water hoses for filling, 3/4 thread adapters, clamps

5 Refrigeration Tools

Nitrogen tank w/regulator for pressure test and brazing
Leak detection spray, electronic sniffer
R410a Manifold Gauges
Vacuum pump to purge line-set, accurate vacuum gauge, 5/16" adapter
Digital weigh scale for measuring balance changes
Clamp-type power meter to measure up to 40-amp current
Tube cutters, bending tools, swage kit
45-degree flaring tool
POE oil, Q-tip to oil flares
Schrader valve removal tool
Brazing torch, MAP gas, SilFos-15 rods
Recovery machine and tank
R410a tank
Portable vice for pipe brazing
Inspection mirror for sight-gauge

6 Balance of System - Supplies

Items below should be specified in the Scope of Work, who is being paid to provide?

Manifold with brazed copper distributor, equal length 1/4" tubes and Tees.
Square Drip Tray - Oatey 30" x 28"
2 pairs Seismic Straps - 30-36" each piece. Screws
Sealant tubes for roof holes, air sealing
Roof flashing for Line-Set like A/C U-L or Emco 5-in-1
[option] Solar-Ready = PVC Conduit 2" Vacuum, couplings, caps, glue
Putty for air sealing holes, tapes
Liquid Teflon for water fittings
Lok-tite for bolts
[option] Vinyl Labels for pipe marking
Thermal paste for sensors
4-5 mm cable clamp for fastening sensor to Panel
#14 1.5 inch S/S roof sheathing screws
Insulated Line Set - match service valve diameter
Line Set clamps
Copper Distributors for 2, 3, and 4 Tee branching
1/4" Tees for liquid lines, 5/16" Tees for gas lines
ACR pancake roll tube from 1/4" to 7/8"
Insulation fit ACR copper
[option] Wall 4 x 4 box to transition line set into mechanical room
[option] Sensor 2 conductor wire AWG24 roll. JST pin connector kits, crimper
[option] Electrical tape, shrink tubes, solder
[option] Boiler Drain 3/4 inch MIPT, plugs
[option] Tank brass 3/4 MIPT plugs
[option] Spare 3/4" brass Pressure/Temp Relief valve
[option] 4" x 4" x 22.4" backing in Attic. 21 pieces per 4 panels, 28/6, 35/8
[option] Steel L-brace for backing = 4" x 4" pieces x 2 = 42/4, 56/6, 70/8

- [option] Recessed wall box for hiding Head
- [option] Drywall 1/4 sheet for each Head rough-in
- [option] Slim-Duct/Fortress brand line-set cover parts
- [option] Pete Ports for Pressure/Temp probe measurement of flow/energy
- Paper towel, hand cleaner, cloths, cleaners

7 Service Parts - Inventory

- Thermistors NTC 10k and 5k with JST connectors and extension wires
- Resistors on JST to test or satisfy E5 E6 at start up
- Wired Controller PCB
- Motherboard PCB
- 240 V 4-pole Contactor
- Fan for cooling the PCB Motherboard
- Apps: Solar Path, Thermal Imaging, Decibel level, Balance R410a
- Filter Drier
- Schrader valves 5/16" (replace – do not reuse)
- Phone or computer Freshdesk support access: <https://sunpump.freshdesk.com>

8 Other Tools - Supplies

Please email pictures of Roof Panels and Mechanical Room for inclusion on our website and referrals
Suggestions to improve Installs?