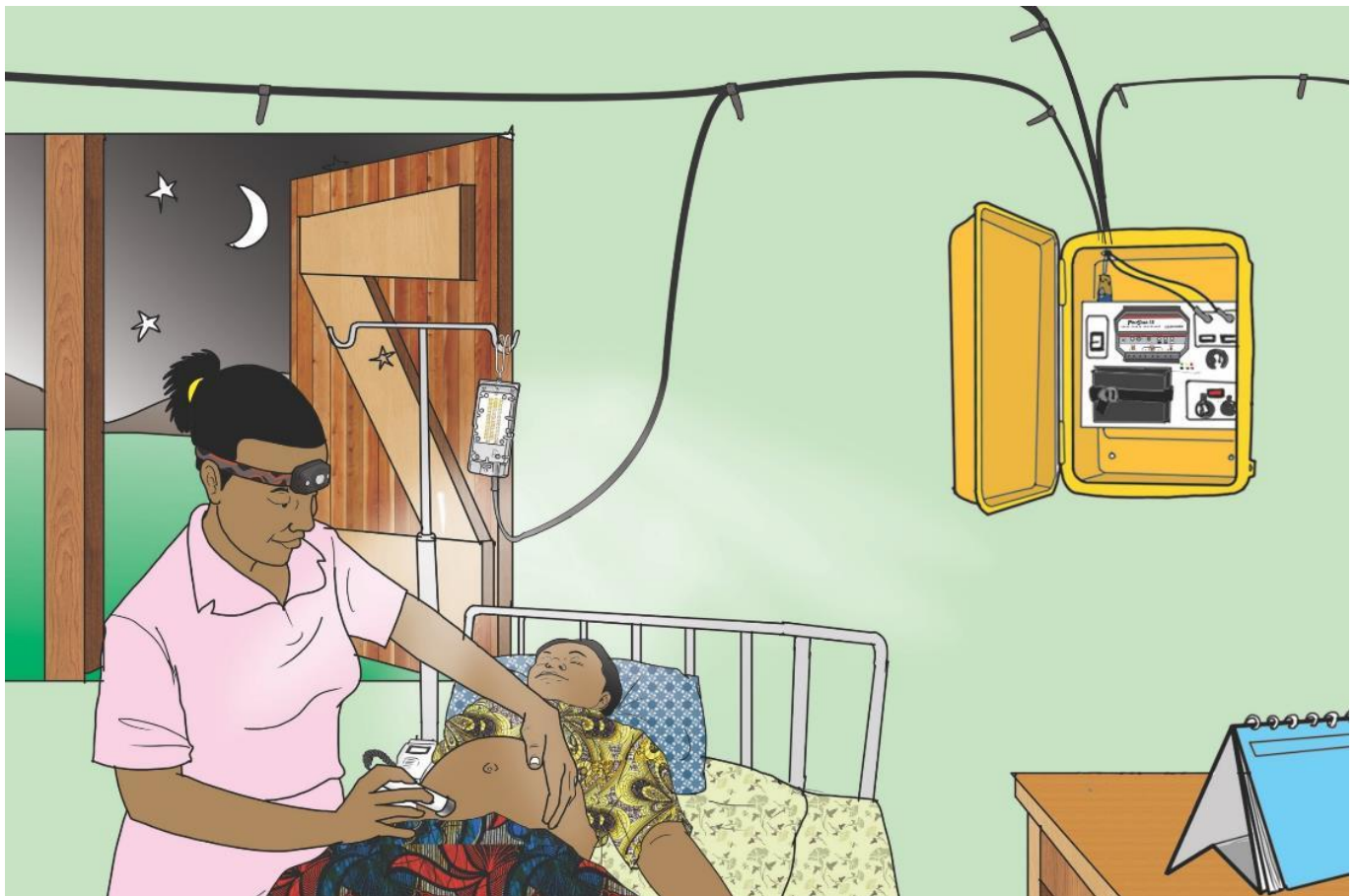




# We Care Solar Suitcase<sup>®</sup>

## Installation Guide

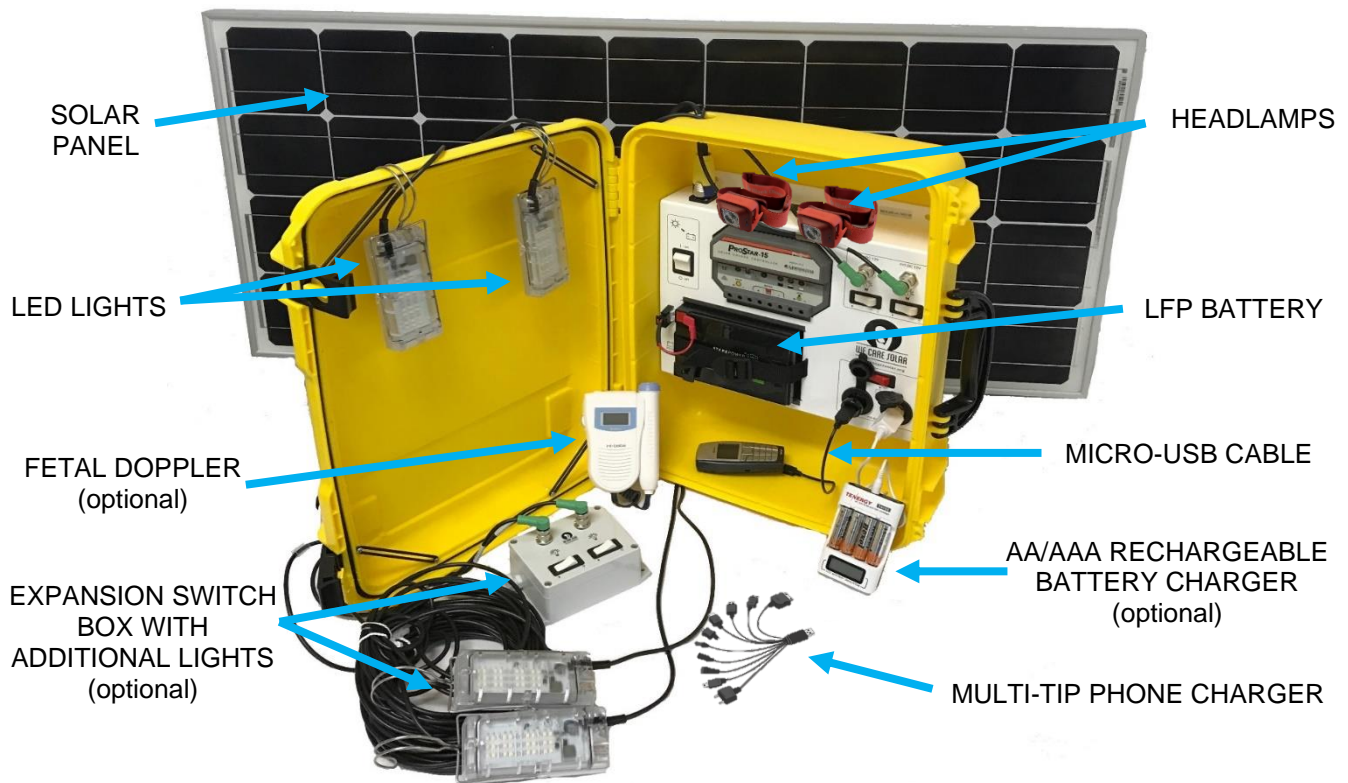
2017



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# Solar Suitcase System Overview



## The Solar Suitcase Includes:

- 1 Lithium Ferrous Phosphate (LFP) 12 volt battery
- 2 bright, rugged LED lights
- 1 homerun cable for solar panels
- 1 wall mounting hardware kit
- 1 roof mounting hardware kit
- Solar panel(s) – ***EITHER:***
  - 2 plastic-backed solar panels (20 watts each)
- OR***
  - 1 aluminum glass solar panel (50-200 watts)

## Appliances:

- 2 rechargeable headlamps with micro USB cable
- 1 multi-tip phone charger
- 1 2-slot USB adapter

## Optional Appliances:

- Fetal Doppler
- AA/AAA battery charger
- Expansion switch box (provides 2 additional lights)

# Understanding the Solar Suitcase

## Batteries, Panels, and Lights

### Battery



The Solar Suitcase includes a Lithium Ferrous Phosphate battery (LFP; 12 volt, 12 amp-hour) that stores electricity for night time use.

The LFP battery lasts for 5 years, and can be fully charged and discharged hundreds of times before it needs replacement. It can also be stored for months without harm to the battery.

The Solar Suitcase is also compatible with Sealed Lead Acid (SLA) batteries.

**Battery Replacement.** After years of usage, if you notice the battery is full at the beginning of the evening, but runs out of charge quickly (for example, the battery cannot provide enough power for one LED light through the night), it is time to replace your battery.

### Solar Panel

The solar panel turns sunlight into electricity. The electricity is used to charge the main battery in the Solar Suitcase. The solar panel for the Solar Suitcase is sized so that the battery can fully charge every day.

Plastic-backed  
(G-10) Everbright  
Panels



Aluminum Glass  
(Conventional) Panel



### Lights



The Solar Suitcase can power two LED lights throughout the night and an additional two LED lights in systems using a 65-200 watt solar panel. The LED lights plug into the light sockets and are secured with the threaded ring that is around the plug. The LED lights can be cleaned with a damp cloth.

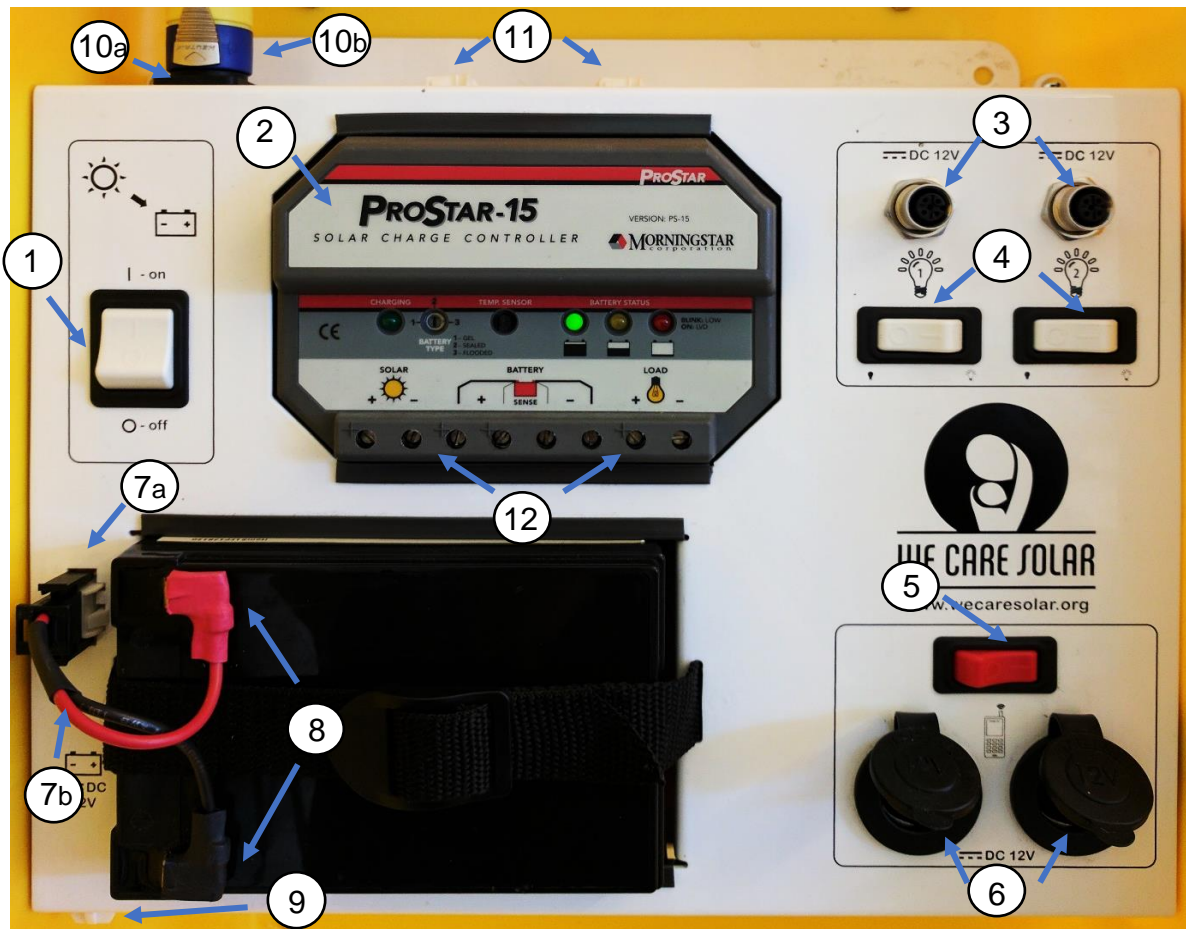


**THIS SOLAR SUITCASE IS 12 VOLT DC**  
The LED lights can only be used with the Solar Suitcase.



# Understanding the Solar Suitcase

## Main Control Board

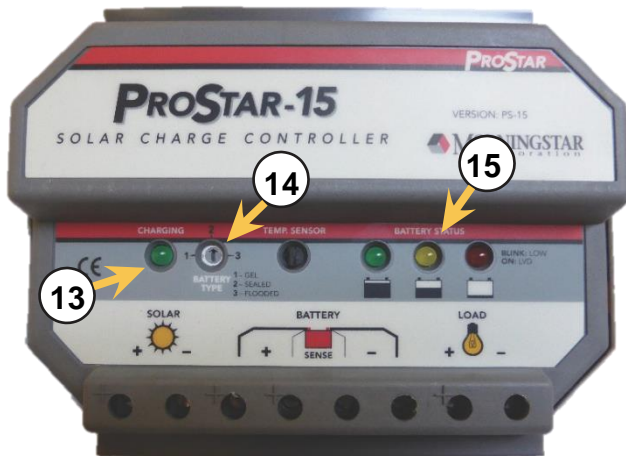


- |                                     |  |
|-------------------------------------|--|
| ① Main power switch/circuit breaker | ⑦b Internal battery cable                |
| ② Charge controller                 | ⑧ Battery terminals/slip-on connectors   |
| ③ Light sockets                     | ⑨ External battery socket                |
| ④ Light switches/circuit breaker    | ⑩a Solar socket                          |
| ⑤ Appliance switch/circuit breaker  | ⑩b Solar plug on homerun cable           |
| ⑥ Appliance sockets (12V DC)        | ⑪ 2 expansion sockets                    |
| ⑦a Internal battery socket          | ⑫ Terminal screws (on charge controller) |

# Understanding the Solar Suitcase

## The Charge Controller

The Solar Suitcase connects solar panels to a charge controller, which optimizes the solar charge into the battery. The charge controller also regulates the use of the energy stored in the battery to power lights and other appliances.



### 13 Solar Charging Light

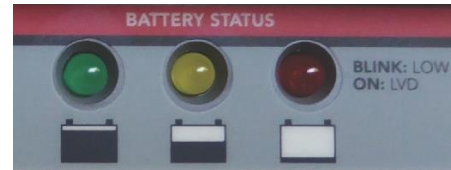


**CHARGING** – During the daytime, when the green charging light is lit, it means that the solar panels are properly wired and that the Solar Suitcase is receiving charge from the solar panels. If you do not see this light in the daytime, the system is not properly connected.

### 14 Battery Type Selector

The selector must be on “**2-SEALED**” for all sealed lead acid, AGM batteries and LFP batteries like the kind that comes with the Solar Suitcase.

### 15 Battery Status Lights



The three colored lights allow the user to assess the level of charge in the battery.

## Lithium Ferrous Phosphate Battery



**BLINKING GREEN** – Battery is full. This is a good time to charge mobile phones and other appliances.



**SOLID GREEN** – Battery is between 10% and 90% charged. You may charge appliances on sunny days.

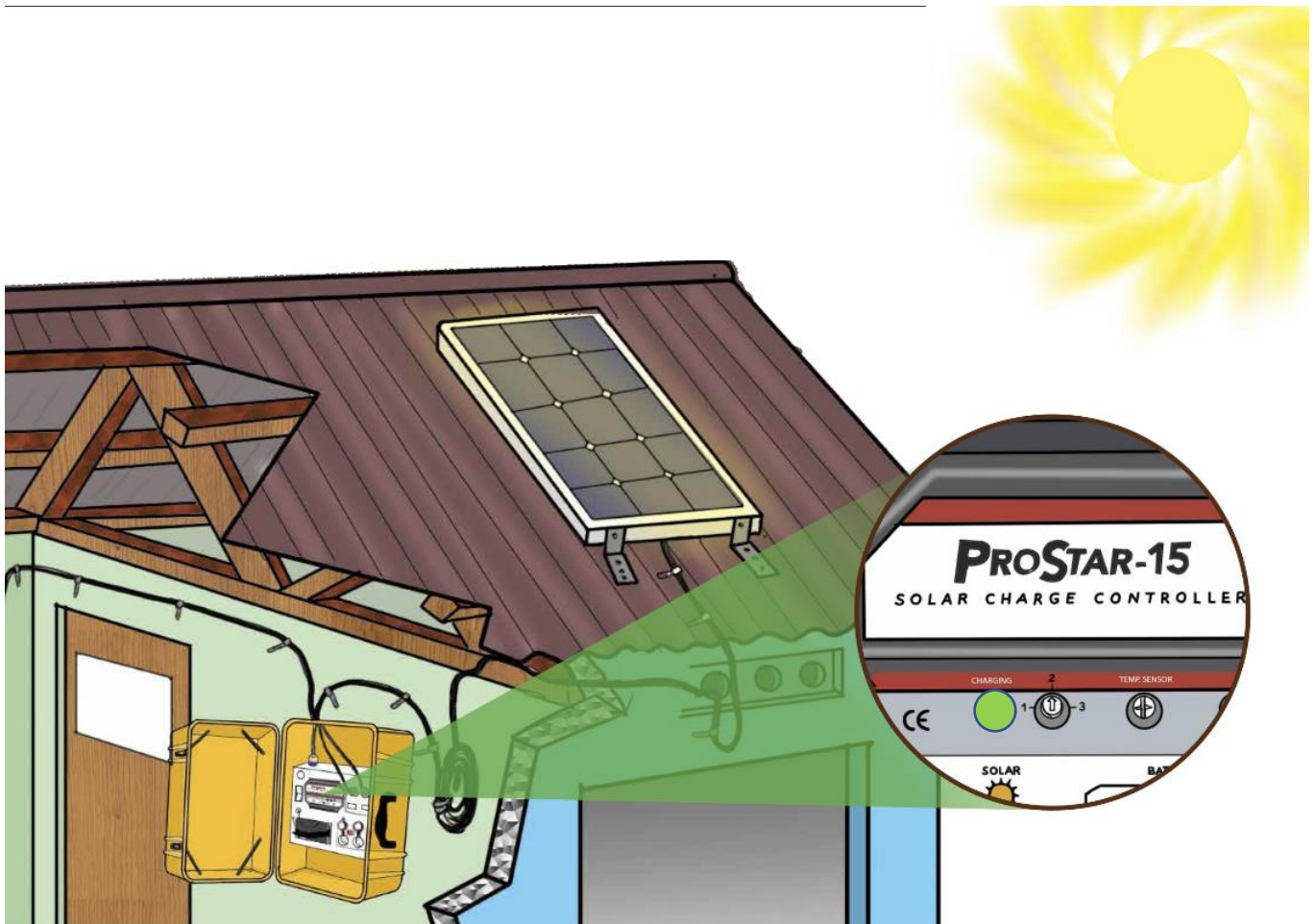


**YELLOW** – Battery is getting very low – 10% or less. Conserve energy. Turn off all lights and discontinue charging appliances.



**RED BLINKING** – Battery is very low and power will soon turn off. Turn off all light switches and appliances. Wait until next sunny day for battery to recharge.

## Solar Charging Light



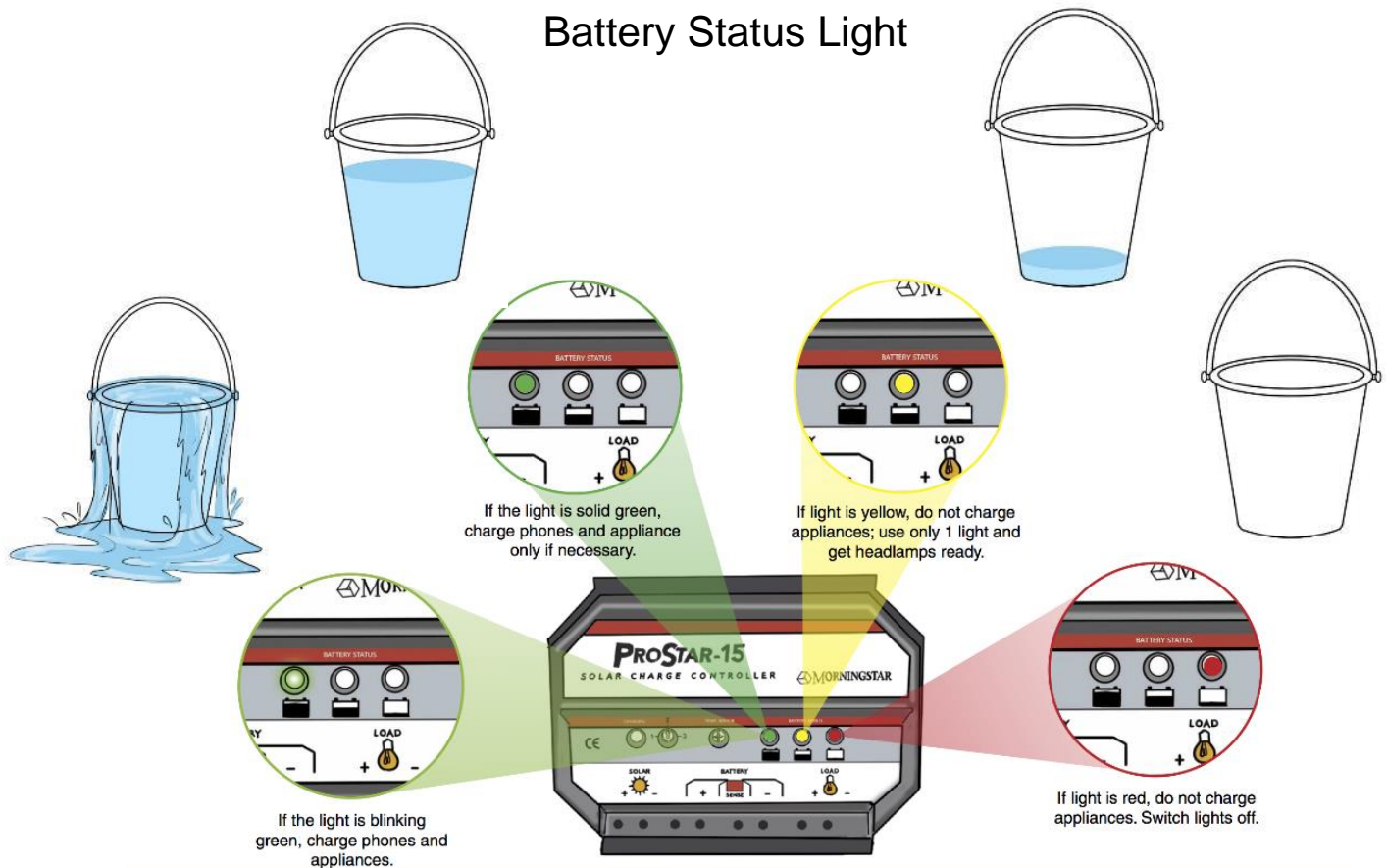
The battery is charged every sunny day.  
But how do you know your battery is charging?

There is a green light on the charge controller above the sun.  
This light is called the solar charging light.

When it is daytime and the homerun cable is properly connected,  
this light will be green.

If you do not see this light in the daytime, the system is not properly connected.

## Battery Status Light



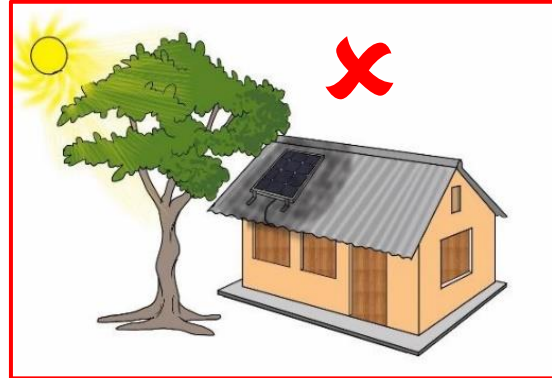
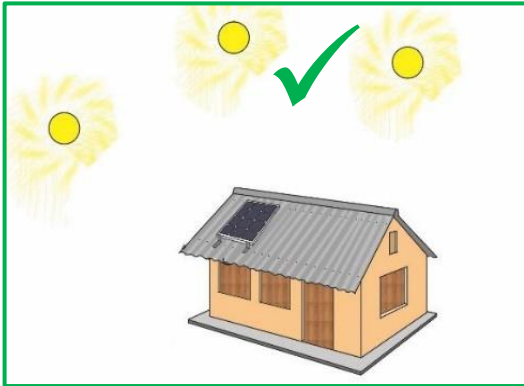
- The battery is like a bucket that holds water. The energy from the sun is like the water.
- The charge controller is like our eyes. It lets you see how much energy is in the battery, like how our eyes let us see how much water is in the bucket.
- If the bucket is overflowing, this is a good time to wash your clothes.
  - Similarly, if the green light is blinking on the charge controller, this means there is overflowing electricity in the battery. This is a great time to charge appliances.
- If you have little water, you would not use the water for washing clothes. You would save the water for drinking.
  - If you only have a small amount of electricity in your battery, you need to save this for lighting at night.
- If the bucket is empty, you cannot use water until the next time you fill your bucket.
  - When the battery is empty, it can only be filled during the next sunny day.



# Getting Started

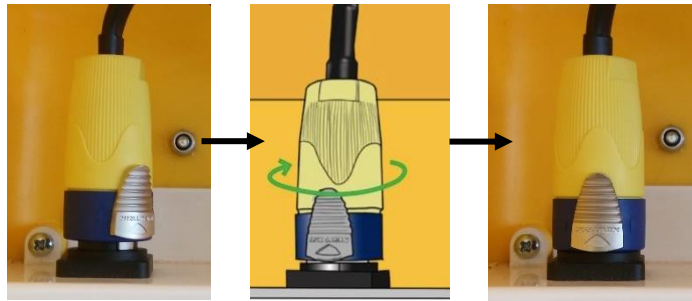
## 1. Place the solar panel(s) in the sun and connect the solar panels to the homerun cable

Place the solar panels in a sunny location. The panels should be permanently mounted on a rooftop with no shade between the hours of 9 AM and 4 PM. The panels should have a minimum of 10 degree slope so that the rain will clean the panels off.



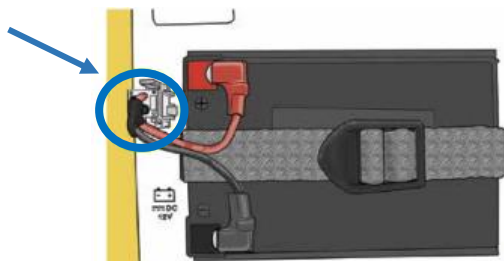
## 2. Connect the homerun cable to the Solar Suitcase

Make sure that the solar plug (yellow and blue) is fully inserted and rotated so that it is locked in. The silver tab will face forward and click into position.



## 3. Connect the battery to the Solar Suitcase

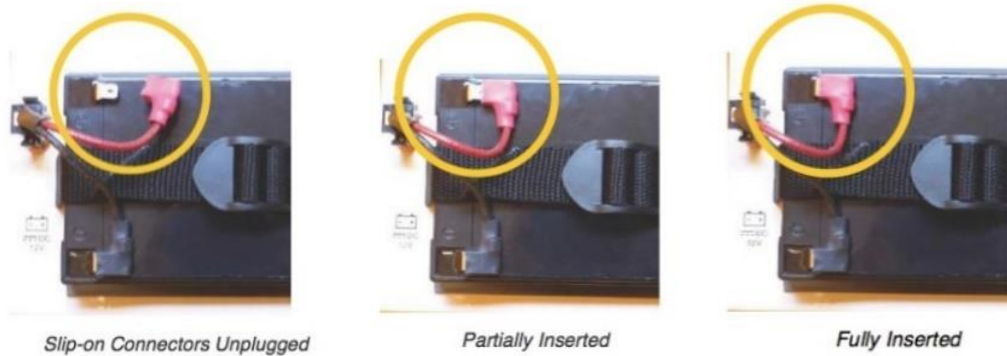
Insert the battery plug into the internal battery socket.



The Solar Suitcase arrives with a battery cable already connected to the battery with slip-on connectors. If the slip-on connectors have come loose from the battery terminals, then:

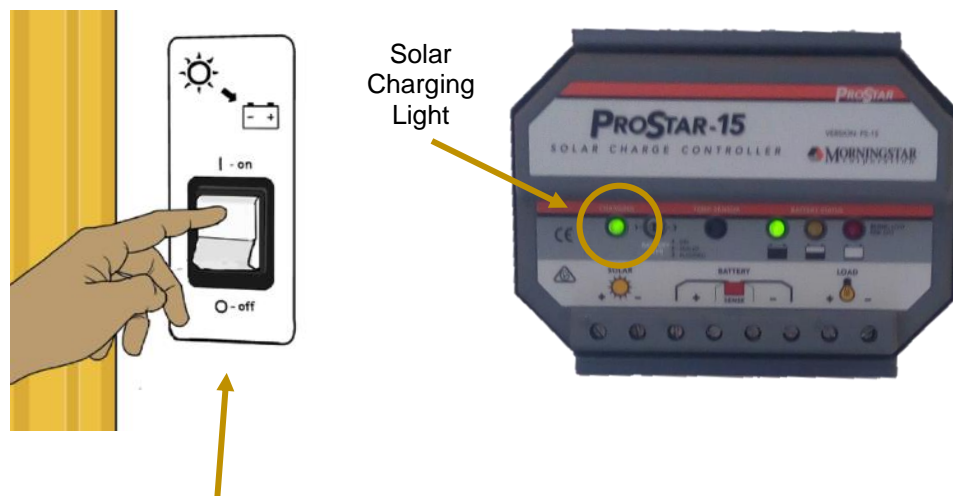
Attach the (+) **RED** terminal on the battery to the (+) **RED** slip-on connector.  
Attach the (–) **BLACK** terminal on the battery to the (–) **BLACK** slip-on connector.

Make sure the slip-on connectors are fully inserted.



#### 4. Turn on the system

Once the solar panel and battery connections are secure, you can turn on the system. Use the main power switch to turn ON the system. The battery status lights will flash in sequence and the charge controller will turn on. After 3 seconds, the solar charging light will glow solid . The Solar Suitcase is now ready to use.



**The main power switch should remain ON at all times** The only time to turn the main power switch OFF is when you are replacing the main battery.

# Appliances

The Solar Suitcase comes with the following appliances:



2 headlamps



Micro USB cable for headlamp

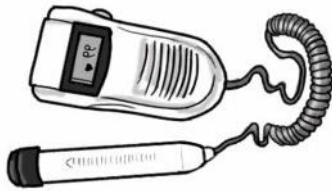


2-slot USB adaptor



Multi-tip phone charger

Depending on the product specifications ordered, your Solar Suitcase may also include the following **optional** appliances:



fetal Doppler



AA/AAA rechargeable battery charger

## Charging Appliances

Appliances should only be **charged during the day** and when the battery status light is **green**. The battery status light on the charge controller will tell you whether or not it is ok to charge appliances.

If the battery is:



**BLINKING GREEN** – Battery is full. This is the best time to charge mobile phones and other appliances.



**SOLID GREEN** – Battery is between 10% and 90% charged. You may charge appliances on sunny days.

**If the yellow or red lights are on, your battery is low. Do not charge any appliances at this time.**

To charge appliances, BOTH the solar charging light AND the battery status light should be green.



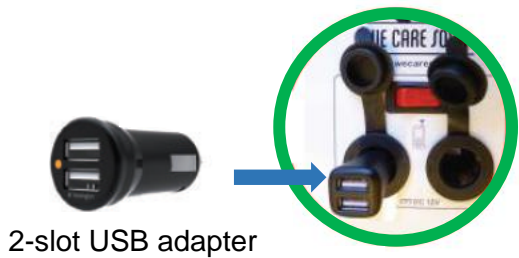
# Appliances

## Phone Charger

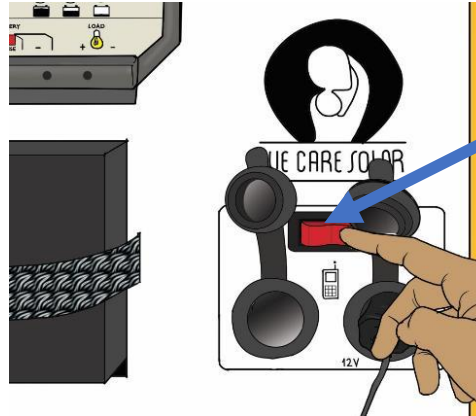
The Solar Suitcase comes with a multi-tip phone charger that is able to charge most types of cell phones.

### *Using the phone charger:*

- 1) Plug the 2-slot USB adaptor into one of the appliance sockets and flip the appliance (red) switch to turn the appliance charger on.

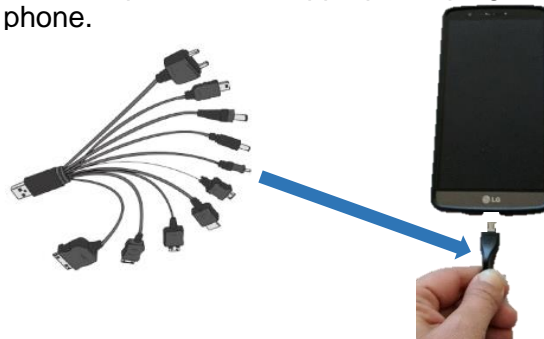
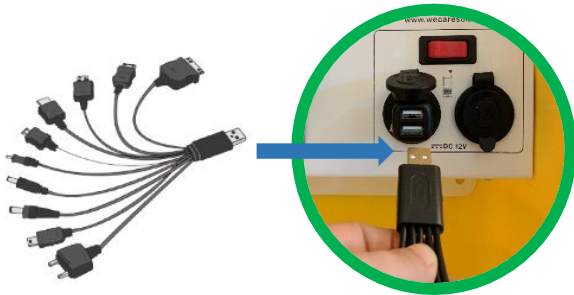


2-slot USB adaptor



The appliance switch turns on both appliance sockets.

- 2) Plug the multi-tip phone charger into the 2-slot USB adaptor and the appropriate plug on the other end of the multi-tip phone charger into the cell phone.



Only charge ONE phone at a time with the multi-tip charger. If you charge more than one at a time, it can break the charger.



You can also use your own cell phone charger with the Solar Suitcase, either by using the 2-slot USB adaptor or by plugging a car charger directly into the appliance socket.





# Appliances

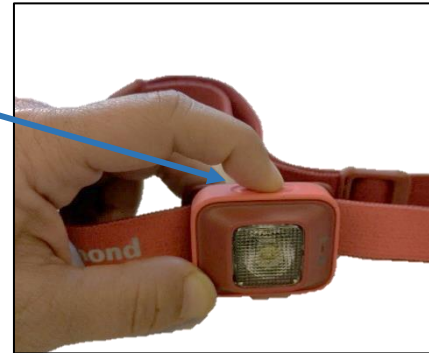
## Headlamps

The Solar Suitcase comes with two headlamps.



### ***Using the headlamp:***

- 1) Use the strap to put the headlamp on your head and push the on/off (top) button to turn it on.
- 2) If fully charged and with the light on the brightest mode, the headlamp will last for about 3 hours. If you want to conserve power, you can dim the light. To do this, hold the on/off button down and the light will get dimmer. To return the light to the brightest setting, simply push the on/off button to turn the headlamp off, and then turn it back on again.
- 3) You can also adjust the angle of the light beam by rotating the light away from the strap once it is on your head.
- 4) When you are done using the headlamp, push the on/off button on the top to turn it off.



### ***Charging Light:***

When you turn the headlamp on, the charging light on the side of the headlamp will briefly flash green, orange, or red, before changing to white. If it flashes orange or red, it is time to charge the headlamp.



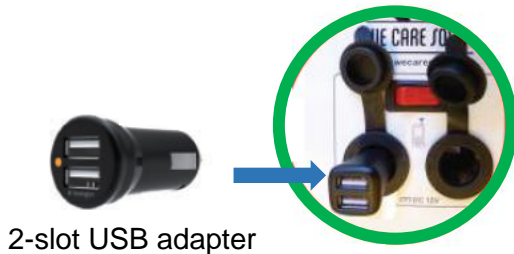
If the charging light is blinking blue when you try to turn it on and it will not turn on, it means the headlamp is locked. To unlock it, hold down the on/off button until the blue light turns off and the main light turns on (about four seconds).



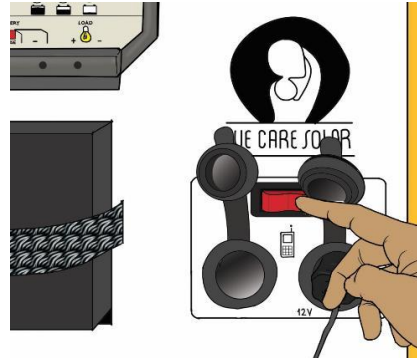
You will also know if the battery is running low if the light does not seem very bright or the headlamp won't turn on at all. The headlamps can be charged just like a cell phone. If the headlamp is completely discharged, it will take about three hours to fully charge it back up.

### ***Charging the headlamp:***

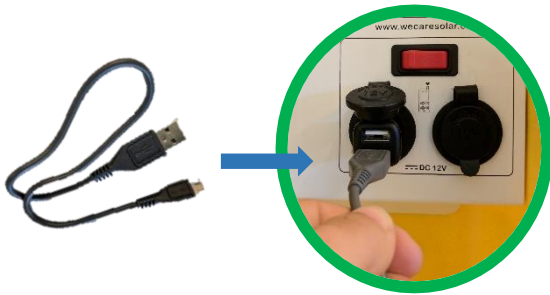
- 1) Plug the 2-slot USB adaptor into one of the appliance sockets and flip the appliance (red) switch to turn the appliance charger on.



2-slot USB adaptor



- 2) Plug the micro-USB charging cable into the 2-slot USB adaptor and plug the other end into the charging port on the side of the headlamp.



When charging, the charging light should be flashing **green**. When the headlamp is fully charged, it will turn to solid green.



# Appliances

## Fetal Doppler

One of the optional appliances in the Solar Suitcase is the fetal Doppler. Midwives use the fetal Doppler to hear a baby's heartbeat and to get a digital reading of the heartbeat. The fetal Doppler can be used instead of a fetoscope.



### ***Using the fetal Doppler:***

- 1) First, palpate the mother to find the position of the fetus
- 2) Place lubricant on the probe
  - For lubricant, you can use ultrasound gel or any vegetable oil
  - DO NOT use water because it does not conduct sound well
- 3) Turn the fetal Doppler ON using the side switch
  - The switch also controls the volume
- 4) Place the probe on the mother's belly
- 5) Listen for the heart rate for five seconds, and increase the volume if needed
- 6) Shift the angle of the probe slightly if you don't hear a heartbeat, and wait again for five seconds
- 7) DO NOT move the probe quickly
- 8) PLACE, PAUSE, and LISTEN

- 9) You have found the heartbeat when you hear a steady heartbeat and the heart on the display is **solid black**
- 10) Turn the fetal Doppler OFF after you are done using it



### ***Understanding the fetal Doppler display***

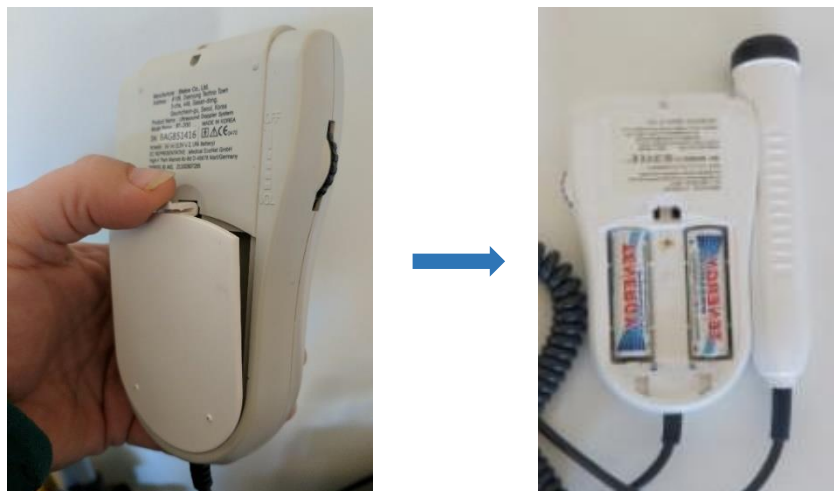
- The normal fetal heartrate is between 120 and 160. If the heartbeat is less than 120 or more than 160, the baby may be in danger
- If the heartbeat remains abnormal, turn the mother on her side, begin intravenous fluids, start oxygen and call for assistance
- Call a doctor or refer the mother to a hospital if the fetal heartbeat remains too fast or too slow
- If the heartbeat is less than 100, it may be the mother's heartbeat. To confirm whether you are hearing the mother, check her wrist pulse with your hand while listening to the fetal heart rate.
- **Remember: You must see a solid black heart in the display to be receiving an accurate heart rate reading**





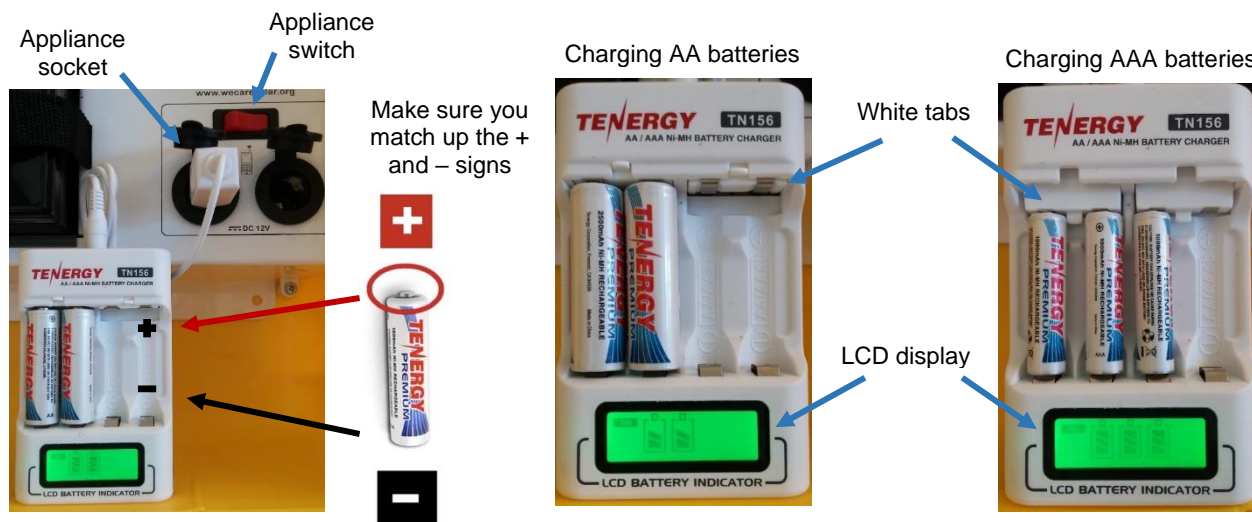
## Charging the fetal Doppler using the AA/AAA rechargeable battery charger:

- 1) Open the back of the fetal Doppler. Remove the batteries for charging.



- 2) To charge, place the positive side of the batteries in the positive side of the charger. To charge AA rechargeable batteries, the small white tab on the battery charger needs to be in the upright position. To charge AAA batteries, the small white tab needs to be moved downwards.
- 3) Plug the rechargeable battery charger into one of the appliance sockets and flip the appliance (red) switch to turn the appliance charger on.

The LCD display will tell you that the batteries are charging and show you when the batteries are fully charged. If the LCD display is not lit, check that the charger is properly inserted into the appliance socket and that the appliance switch is turned on.

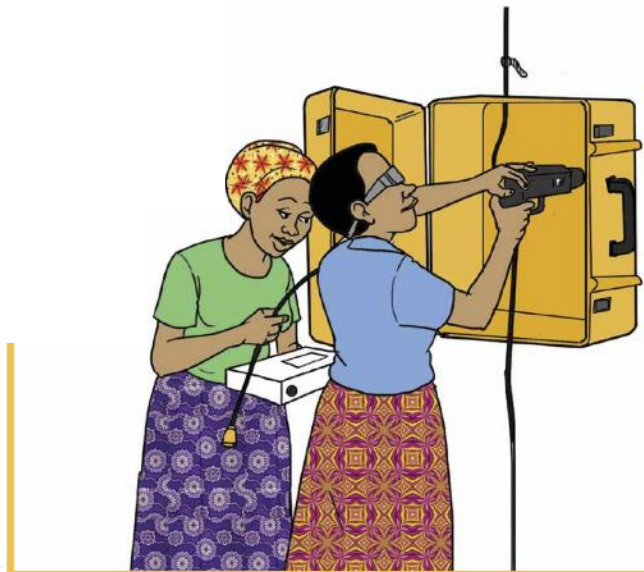


**IMPORTANT:** The battery charger can charge *rechargeable (NiMH)* AA batteries (like those that come in the fetal Doppler) and rechargeable AAA batteries. The charger **CANNOT** be used with single-use (Alkaline) batteries. If you place single-use batteries into the battery charger, the charger will break. Charge the batteries in “families”, meaning all the batteries that go with an appliance should be charged together at the same time.



# Installation Guide for Solar Suitcases

1. Installation Planning
2. Installing the Solar Panel
3. Installing the Solar Suitcase
4. Installing the LED Lights
5. Installation Paperwork



# Installation Planning

## Planning - Before Installation Day

1. Identify installation team. Most teams will include one driver and 2-3 technicians.
2. Location planning – Call the clinic at least one day in advance.
  - a. **Ensure the person in charge of the clinic will be present on installation day**, as well as most of the midwives so that they can be trained on Solar Suitcase use and maintenance.
  - b. **Make sure there have been no recent changes to the electricity status of the facility.** For example, it is possible the facility may have received alternate solar power or been connected to the grid since the facility was assessed.

## Installation Day - Steps

1. Leave early – in most places working on the roof after noon is HOT. You also want to leave time for unexpected delays (e.g. car trouble).
2. Prepare and load tools and equipment in vehicle. Review preparation checklist (next page).
  - a. When possible, bring an extra Solar Suitcase for teaching.
  - b. Bring food and water – often there is little available at the site and it is a long and potentially unsafe day without sustenance.
3. Arrive and introduce yourselves to the person in charge of the clinic. Take a tour of the clinic with the medical team.
4. Identify the best location for the Solar Suitcase, lights, and solar panels.
  - a. Engage the health workers at the clinics, as they are the best source of information. They know how rooms are used, which doors are locked, where the equipment will be safe, etc. Start with them and then consider the technical options second.
  - b. When determining light placement, don't forget to ask the three main questions (Where do you stand when conducting deliveries? Where do you care for the baby after delivery? Where does the mother rest after giving birth?)
5. Organize team – assign responsibilities to roof lead, ground lead, and teaching lead. You will get more consistent results if people are responsible for specific activities.
6. Complete installation of solar panels, Solar Suitcase, and lights. Review checklist for each.
7. Train the healthcare workers how to use and maintain the Solar Suitcase and review checklist.
8. Complete paperwork.\*
9. Review final installation checklist.\*\*
10. Clean up the site – take away debris and re-organize any furniture moved.
11. Present clinic certificate to person in charge of clinic and midwives. Take a photo of them in front of the Solar Suitcase.
12. Take photos of installation. Show us your good work!
13. Re-organize tools, load vehicle and depart prior to dark.

**\* Paperwork is extremely important. Please take the time to complete the necessary documentation.**

**\*\* Checklists reduce errors – Use them!**

## Installation Day Preparation Checklist

When packing up your equipment in the vehicle to drive to an installation, use this checklist to make sure you do not forget anything:

1. Solar Suitcase + 1 extra for teaching health facility staff – Make sure that appliances, installation hardware, user manual, and poster are inside the Suitcase
2. Solar Panel(s) + 1 extra in case of breakage
3. Installation paperwork (stickers, tracking sheet, receipt, certificates, baseline form, etc.)
4. Toolbag – Make sure the toolbag includes all the necessary tools for installation
5. Drills – Make sure the drill batteries are charged and you bring the charger
6. Ladder for reaching the roof (+ step ladder for installing lights indoors if you have one)
7. Water and snacks for during installation
8. Camera for taking photos at installation





# Installing the Solar Panel

## Step 1: Safety

**LOOK** – Identify any potential dangers. This includes power lines, skylights, wasps, bats, holes in the roof, or rusty spots on the roof.

**PLAN** – Work safely. Make a plan with your team on how to work safely and communicate with your team.

**BE AWARE-** Do not touch electricity lines with your body or ladder. Do not walk near or over skylights. Avoid wasp nests. Avoid attics with bats or rodents.



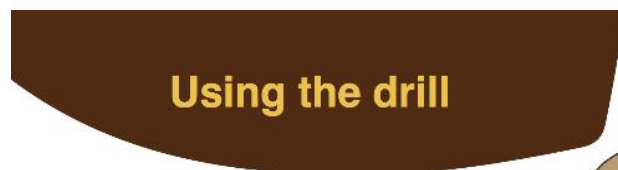
If roof is too steep or too weak for you to work on safely you can:

- Mount the solar panel on the eave of the roof while standing on the ladder. We do NOT want you to risk getting hurt.
- Mount the solar panel on a post or build a structure near the clinic to mount the solar panel and then route the Homerun cable into the clinic.



## Ladder safety

- When you use a ladder, be careful and make sure it is stable before you climb.
- When standing at the base of the ladder, your outstretched arms should be able to reach the ladder.
- Only one person should be on the ladder at a time.
- Climb with your eyes facing the ladder.
- Have someone hold the ladder.
- When getting off the ladder onto the roof, step around the ladder and *not* over the top of the ladder.



## Using the drill

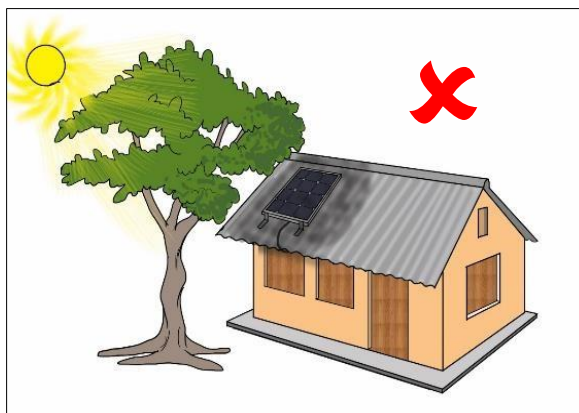
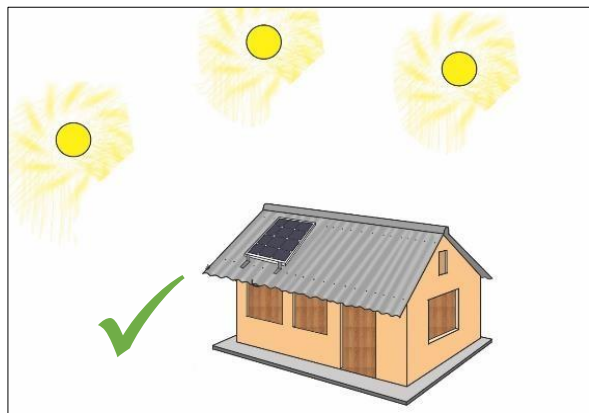
- Wear safety glasses when you are drilling.
- Make sure to point the drill straight.
- Use speed 1 for attaching screws and for drilling into concrete
- Use speed 2 for drilling into the panel



## Step 2: Decide where you will place the solar panel.

### Where is the best place to install the solar panel?

A solar panel needs sunlight to get energy, so install it where there are **no shadows** and where it gets **sun all year**.

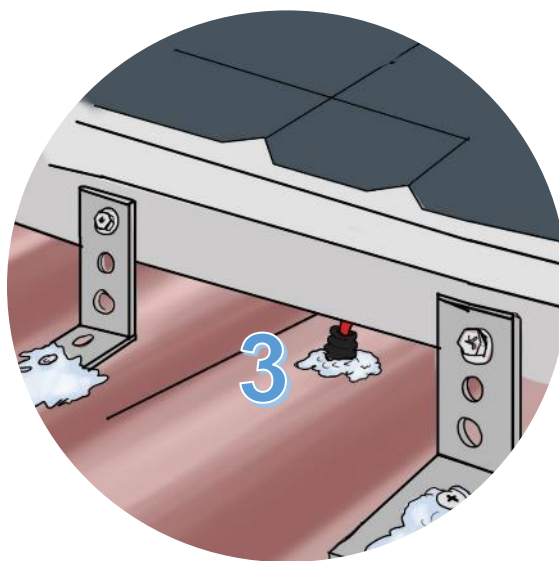
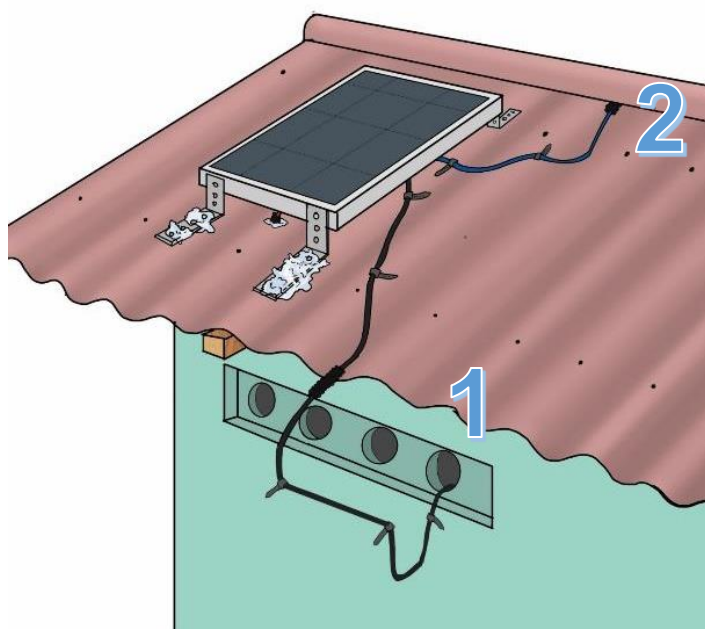


### How far should it be from the Solar Suitcase?

The homerun cable that connects the panel to the Solar Suitcase is **only 11 meters**.

The picture shows 3 different ways the homerun cable could be routed:

1. Over the edge of the roof.
2. Under the ridge-cap of the roof.
3. Through the roof itself.



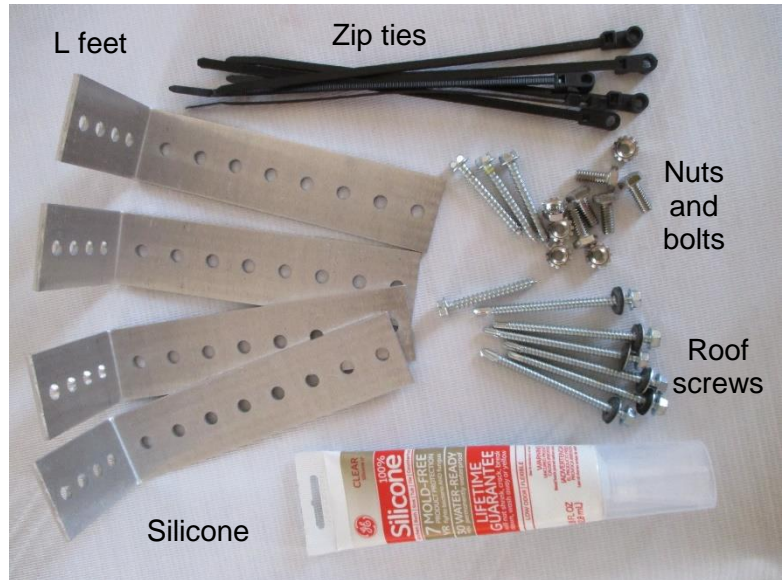
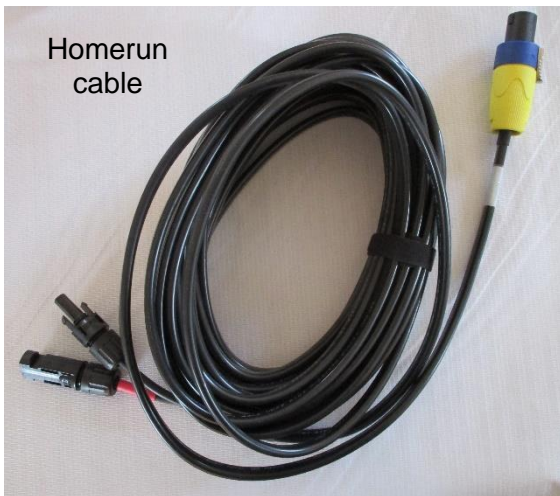


### Step 3: Prepare the tools.

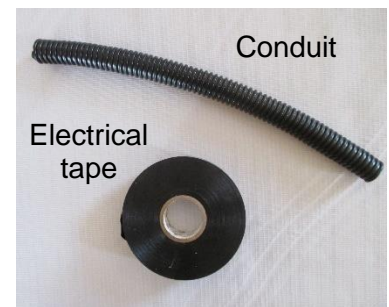
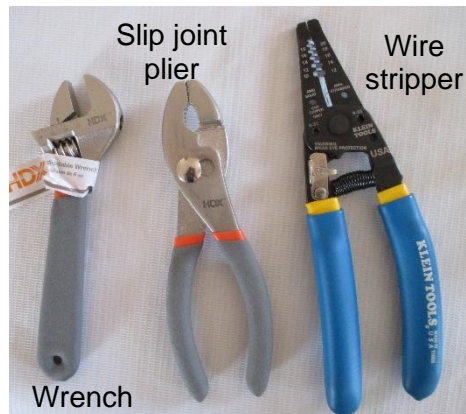
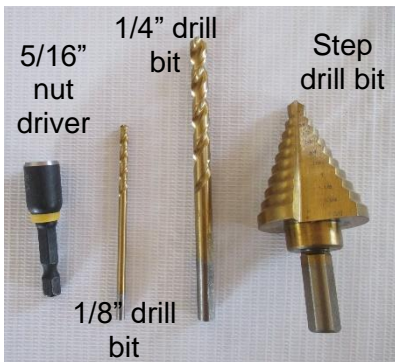
Prepare your equipment before climbing onto the roof so you do not have to climb many times and put yourself at risk.

You will need the following tools to install the Solar Panel:

#### *From the Solar Suitcase:*



#### *From the toolkit:*



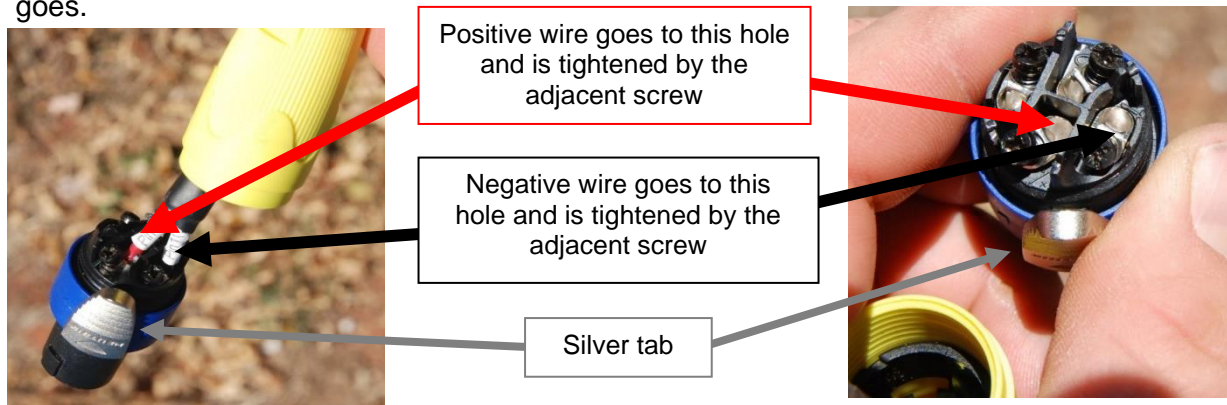


## Step 4: If needed, prepare the homerun cable by removing the solar plug.

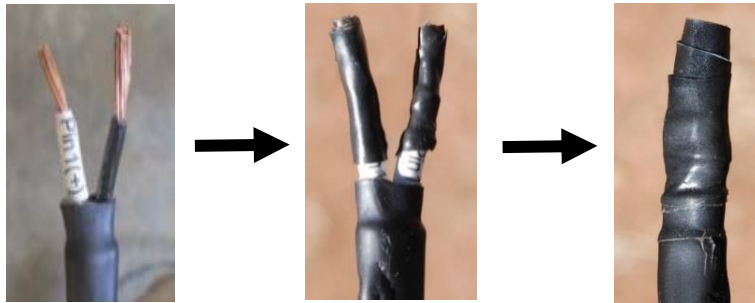
Sometimes it is easier to remove the solar plug when you are installing the solar panel. When you remove the solar plug, it is important to protect the wires with electrical tape so that they are not damaged while being passed through or over the roof.

### To remove the cable from the solar plug:

- Unscrew the yellow and blue connector piece.
- Look carefully: There are four holes, but only two are used.
- Make note before removing the wires where the positive (+, red) and negative (–, black) wires go.
  - In the photos below, the hole to the left of the silver tab (marked “1+”) is where the red positive wire goes. The hole to the right of the silver tab (marked “1–”) is where the black negative wire goes.



- Loosen the screws until the wire can be removed. However, do not remove the screws.
- Using electrical tape, tape the wires separately and then together to protect them from damage.



### To reattach the cable to the solar plug:

- Remove the protective electrical tape.
- Make sure to insert them into their correct holes. You must insert both wires in their respective holes at the same time.
- After inserting the wires into the proper holes, make sure the screws are tight.
- Pull on each wire to ensure they are locked firmly to the plug by the screws.
- Complete the job by putting the yellow and blue connector together and checking that it was done correctly.
  - The easiest way to check if it was done correctly is by plugging the homerun cable into the Solar Suitcase and seeing that the green solar charging light on the charge controller is illuminated. (Note: The homerun cable should be attached to the solar panel and the solar panel should be in the sun.)

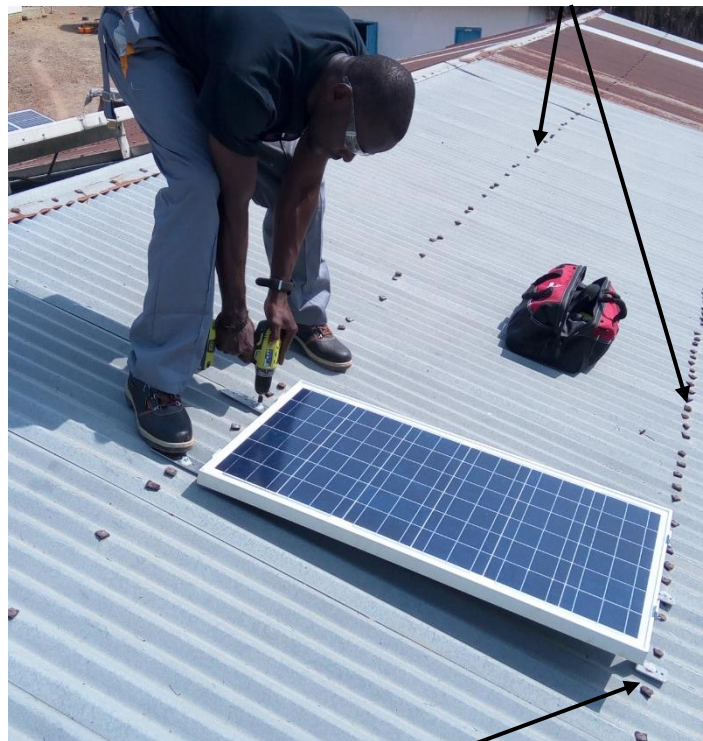
## Step 5: Go up onto the roof and plan where you will mount the solar panel.

### Choose carefully where you will step on the roof.

Look for a line of nails. The nails mean that there is a beam or rafter under the iron sheet. This is the safest part of the roof to walk on. Once you are on the roof there are a few more things to consider before attaching the panel.

- The solar panel must be attached to two beams.
  - You may need to adjust your L-feet to allow you to reach beams above and below the panel
- Tilt the panel 10-15 degrees to allow rainwater to flow off the panel and to maximize sun exposure (see figure 2).
- On rare occasions, if you can't reach both beams, you can secure the middle of the panel to the beam using an L-foot on each side. Use one L-foot on the top and bottom of the panel to keep the panel from shifting (see figure 1).
- Depending on the situation, the L-feet can be placed in different positions in order to best reach the beams and change the angle of the panel.

Nails in the roof indicate roof beam location



L-foot is attached to the beam, indicated by the location of the nail

10-15  
degree tilt

Dotted red lines indicate roof  
beam location

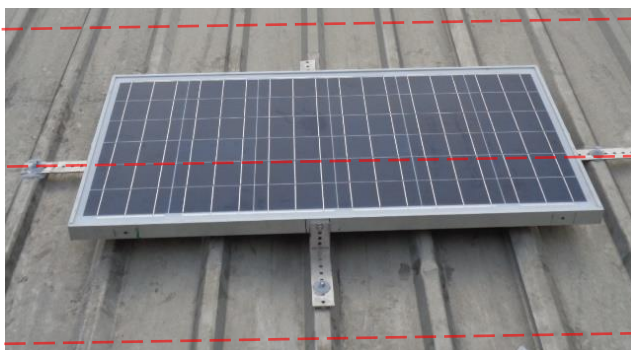


Figure 1

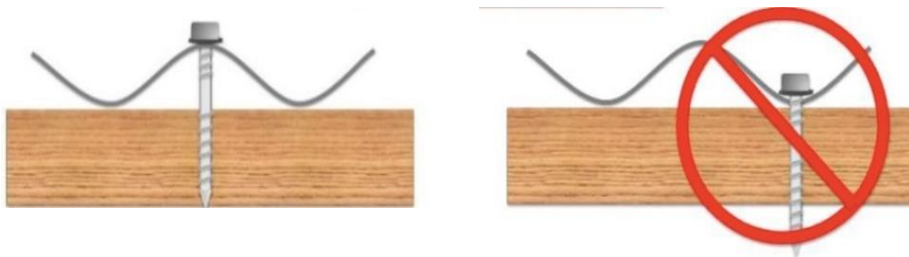


Figure 2

## Step 6: Drill into the solar panel.



1. Locate the timbers/beams so that you will be able to screw the L feet into the roof timbers (framing/main support beams) and **into the peak of the corrugation**.



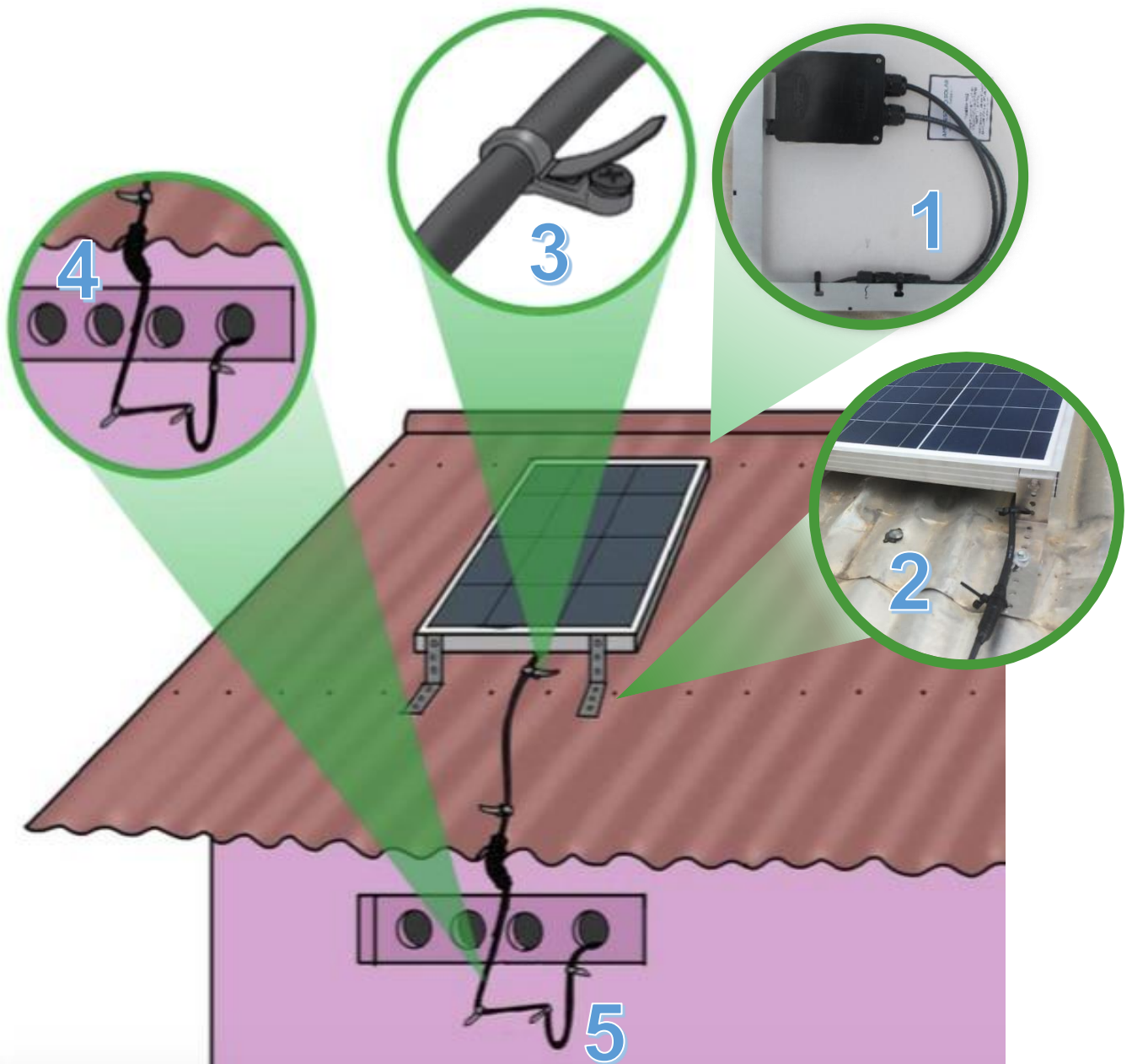
2. Mark the solar panel frame where the L feet are.
3. Mark the exact spot where you will drill into the panel on the center of the frame and the same distance from the edge of the frame.
4. Protect your eyes with the safety glasses and protect the back of the panel with an L foot.
5. Use the 1/4" drill bit to make the holes in the solar panel for the bolts to attach the L feet.



## Step 7: Secure and protect the homerun cable.

Before you attach the solar panel to the roof, secure and protect the homerun cable. (The drip loop can be done after the solar panel is installed.)

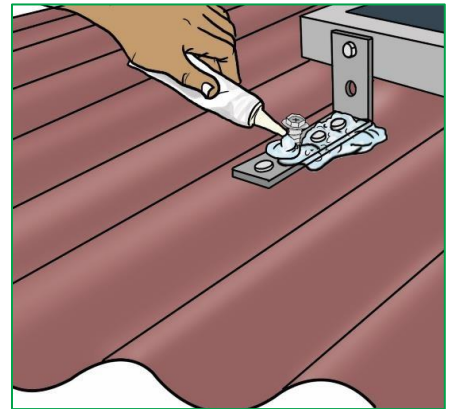
1. Stress relief near the junction box
2. Stress relief at another point on the panel
3. Stress relief on the roof
4. Protect the edge with conduit
5. Make a drip loop



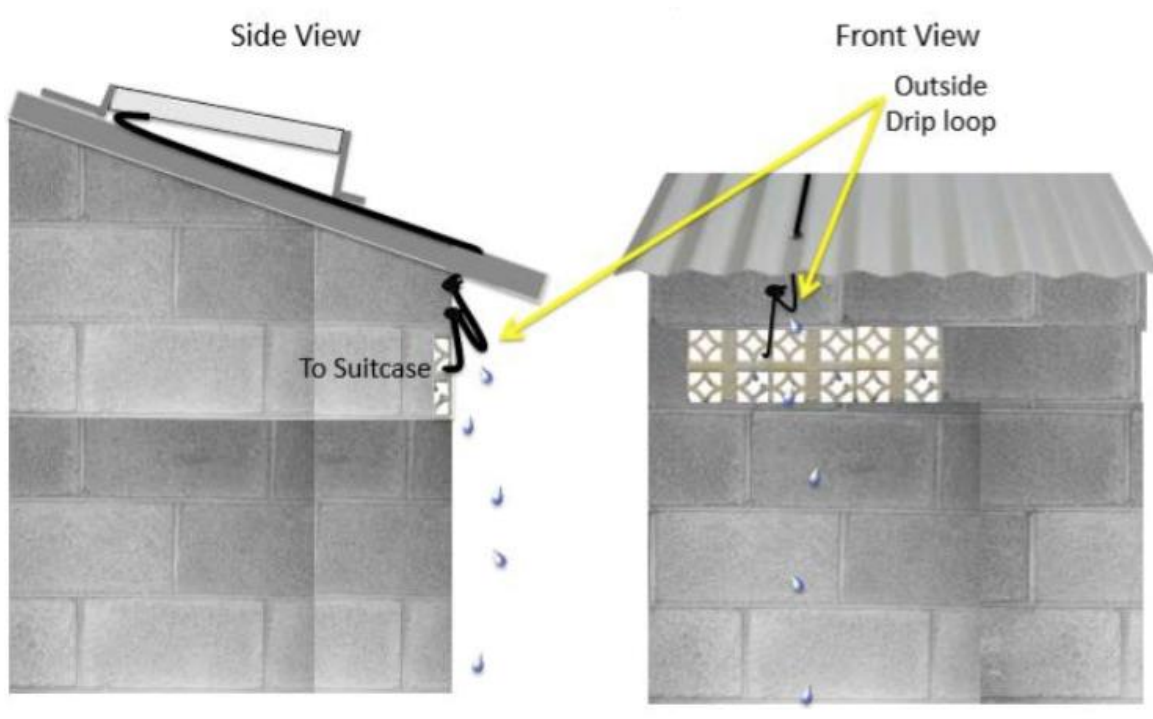


## Step 8: Install the solar panel onto the roof.

1. Secure the L feet onto the solar panel using adjustable wrenches.
2. Mark the roof where you will attach the L feet. *(Note: Do not mark where you will drill onto the roof until the L feet are attached to the panel.)*
3. Use the long roof screws to attach the L feet to the roof.
4. Be sure to use silicone to seal all the holes.

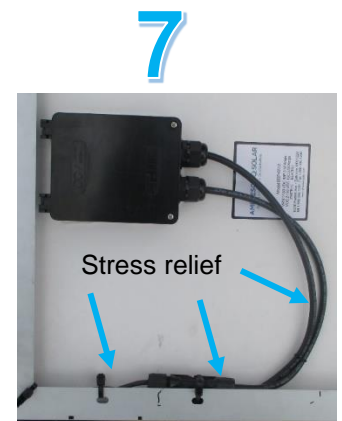
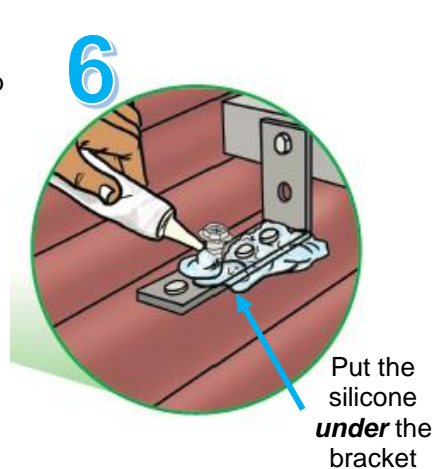
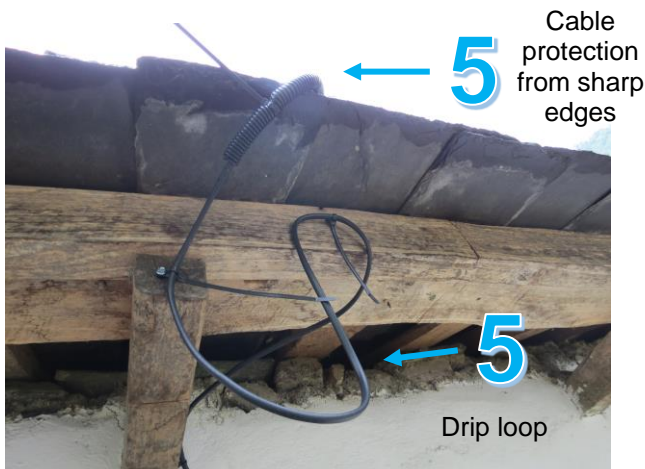
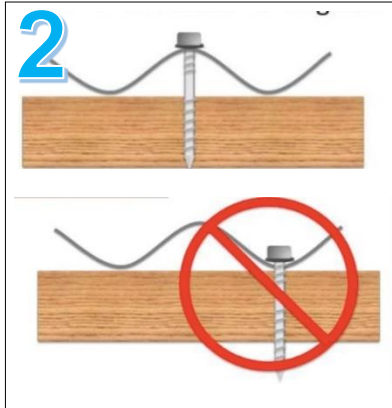
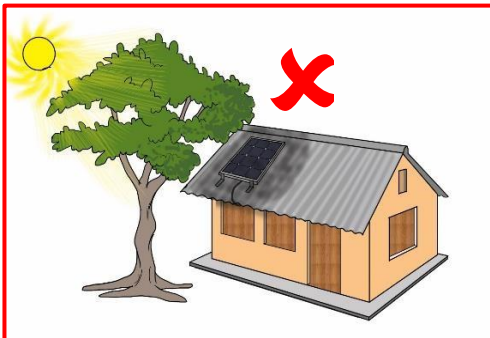
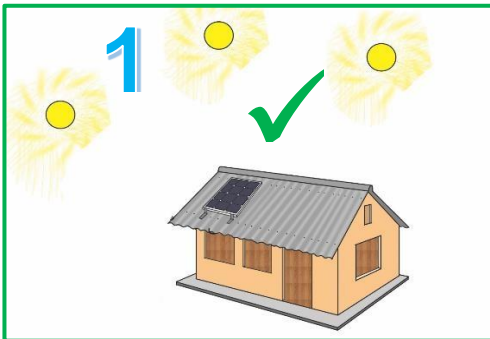


## Step 9: Protect the Solar Suitcase from water damage by making a drip loop with the homerun cable.

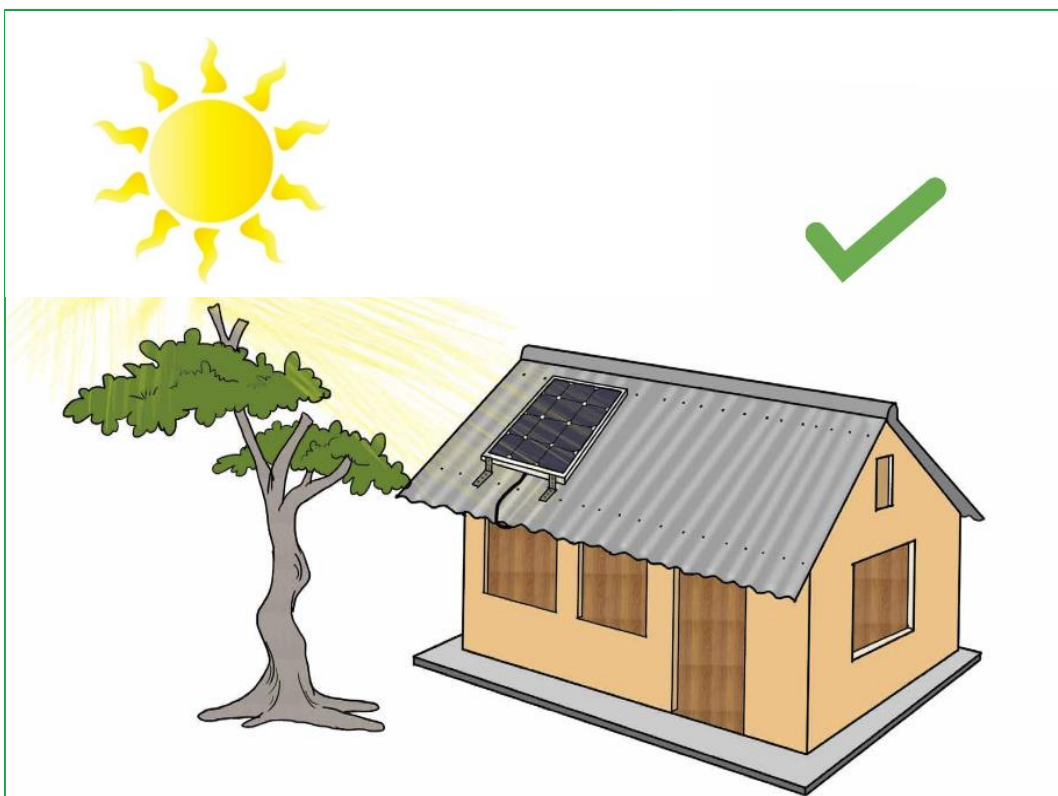
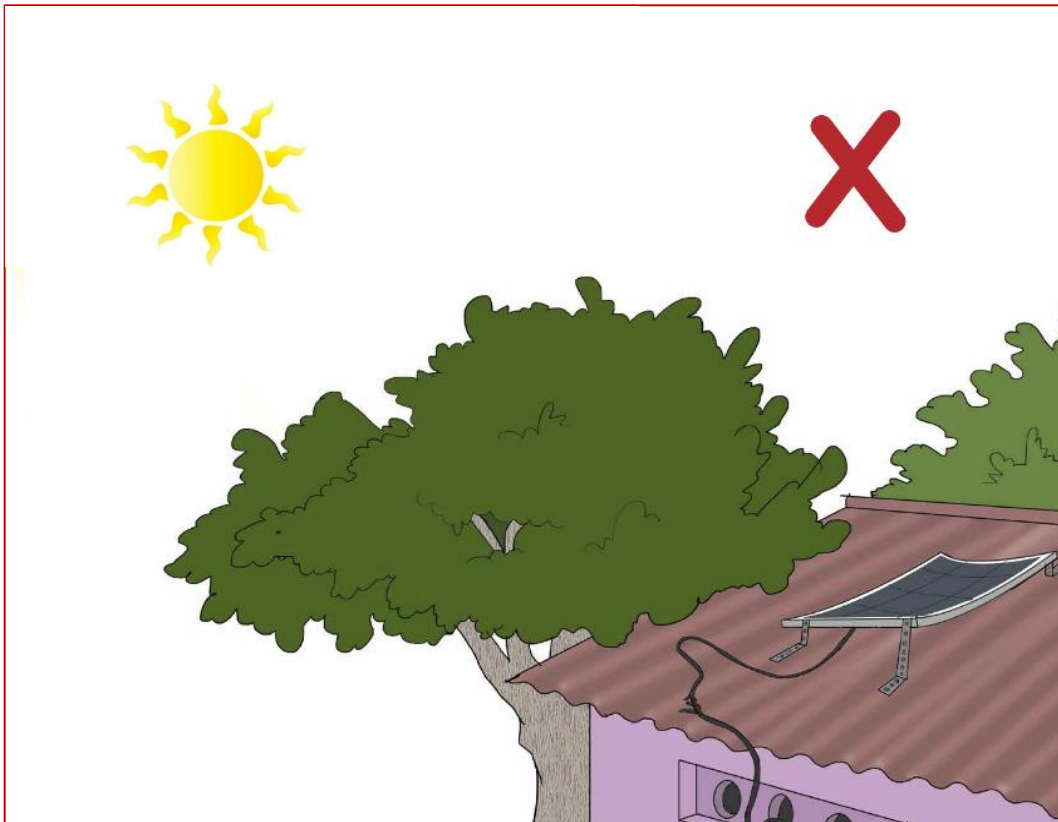


## Solar Panel Installation Checklist

1. Solar panels have best access to sunshine and NOT SHADED ANY TIME of day.
2. Solar panels are securely attached to the roof beams at the peak of the corrugation.
3. Solar panels are installed at a tilt to prevent build-up of dirt and rain water.
4. Solar panel frame looks straight and panel is not twisted.
5. Homerun cable is wrapped with extra protection (e.g. with conduit) in places it might be damaged (sharp edges, doorways, etc.) and has a drip loop to protect water from getting into the Solar Suitcase.
6. All roof holes are sealed with silicone.
7. Cables on the back of the solar panel have stress relief to prevent the cable from being pulled.



What's wrong with this installation?



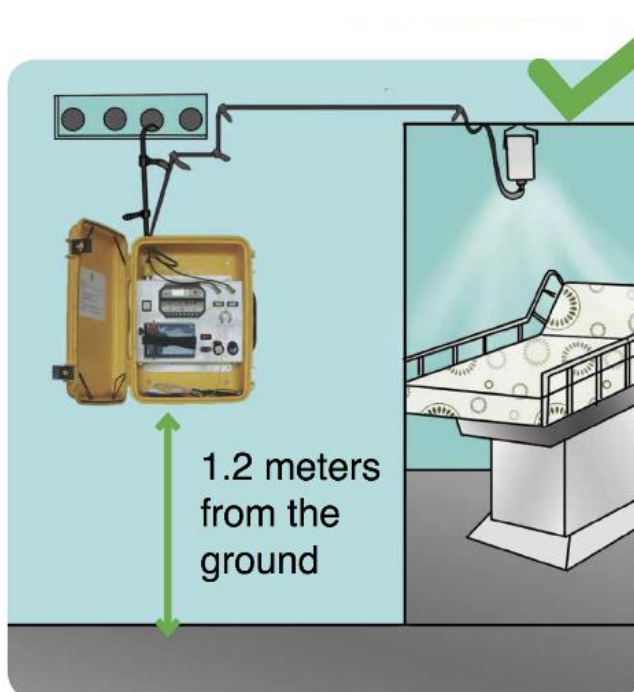


# Installing the Solar Suitcase

## Step 1: Choose a good location for the Solar Suitcase.

Before you install the Solar Suitcase, you need to make sure you have a good location that meets the needs of the healthcare staff:

- The Solar Suitcase gives power for the LED lights.
  - Install the Solar Suitcase where the lights can reach the delivery room.
  - Consider how the homerun cable from the solar panel on the roof will reach the Solar Suitcase.
- The Solar Suitcase has important appliances that should be easily accessed but are also safe.
  - Install in a room that is easy to access and secure.
  - Install where the door of the Solar Suitcase opens easily and is at a good height for the midwife to reach the light switches.
  - Do not install over water or over a patient bed.
- The Solar Suitcase is designed to be attached to the wall. However, sometimes you need another solution.
  - If the wall is too soft and the wall crumbles when drilling or the Solar Suitcase cannot be installed permanently,
  - Install it on a table to protect it from theft.





## Step 2: Prepare the tools

The Solar Suitcase wall mounting kit has the tools you need to install the Solar Suitcase:

1. Larger hex head screws. Use these to attach the Solar Suitcase to the wall.
2. Use plastic screw anchors for screws in concrete or brick.
3. Zip ties can help you secure wires and cables to the wall.
4. There are smaller screws to attach zip ties to the wall.
5. You can use the hooks to hold lights that are moveable.
6. You can also use hooks to hold light wires.
7. Use the Velcro ties to keep the wires bundled and neat.
8. Screwdriver



You will also need the following tools from your toolkit:

9. Drill
10. 5/16" driver bit
11. Masonry drill bit or standard drill bit (depending on the wall type)
12. Safety glasses
13. Level



### Step 3: Install the Solar Suitcase on the wall

1. Remove the contents of the Solar Suitcase, including the main control board (Fig. 1).
2. Drill four holes in the back of the Solar Suitcase *outside of where the main control board will be reattached* (Fig.2).
3. Mark the wall where you will drill into the wall.
  - Use two people to mark the wall.
  - Make sure the Solar Suitcase doesn't move during marking – if not the holes will not line up.
  - Place a level on top of the Solar Suitcase to make sure the Solar Suitcase is even.
4. Set the first plastic anchor:
  - Drill holes 4 centimeters deep into the wall.
  - Insert the anchors into the holes all the way into the wall.
5. Attach the suitcase to the wall and mark the other 3 holes.
  - Use the level to keep it straight (Fig.3).
6. Take down the Solar Suitcase and place the remaining 3 plastic anchors.
7. Permanently install the Solar Suitcase to the wall with the LARGER hex-head screws.
8. Put the main control board back into the Solar Suitcase.
9. Cut grey plug so that it can wrap around the wires entering the Solar Suitcase and push it back into the hole to keep dust out



Remove all the contents of Solar Suitcase



Be sure to drill the holes outside of where the main control board will go.



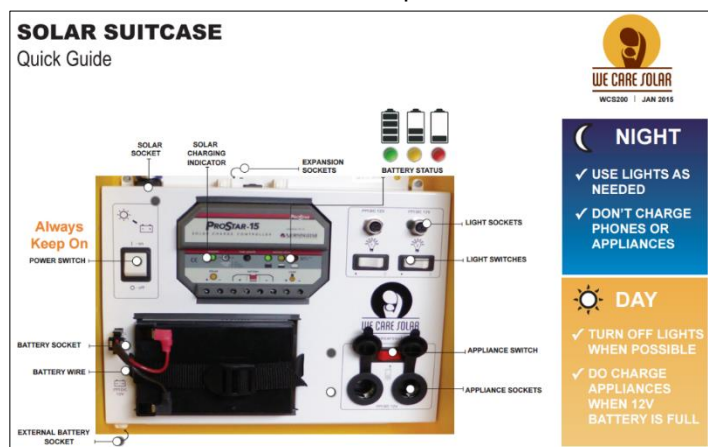
Use the level to keep it straight

## Step 4: Attach the poster and stickers

1. Attach Solar Suitcase poster to the wall near the Solar Suitcase in a place where the health workers can see it.
2. Fill in battery sticker and affix to battery.
3. Fill in Solar Suitcase sticker and affix to inside of Solar Suitcase door.

**\*\*See section titled “Installation Day – Documentation” for more details.**

Solar Suitcase poster



## Additional Solar Suitcase installation options

### Reversing the door swing

*If you want the Solar Suitcase door to open on the other side, follow these steps:*

1. Remove the main control board
2. Rotate the Solar Suitcase 180 degrees
3. Drill a new hole in the new top of the Solar Suitcase for HR cable entry point

### Table mount

*If the wall is too soft to install the Solar Suitcase, you can install it on a table:*

- Mount the Solar Suitcase on a table that is a convenient height for use
- Attach the Solar Suitcase to the table with screws to prevent theft.
- Be sure to keep cables organized and off of the floor.



Table mount



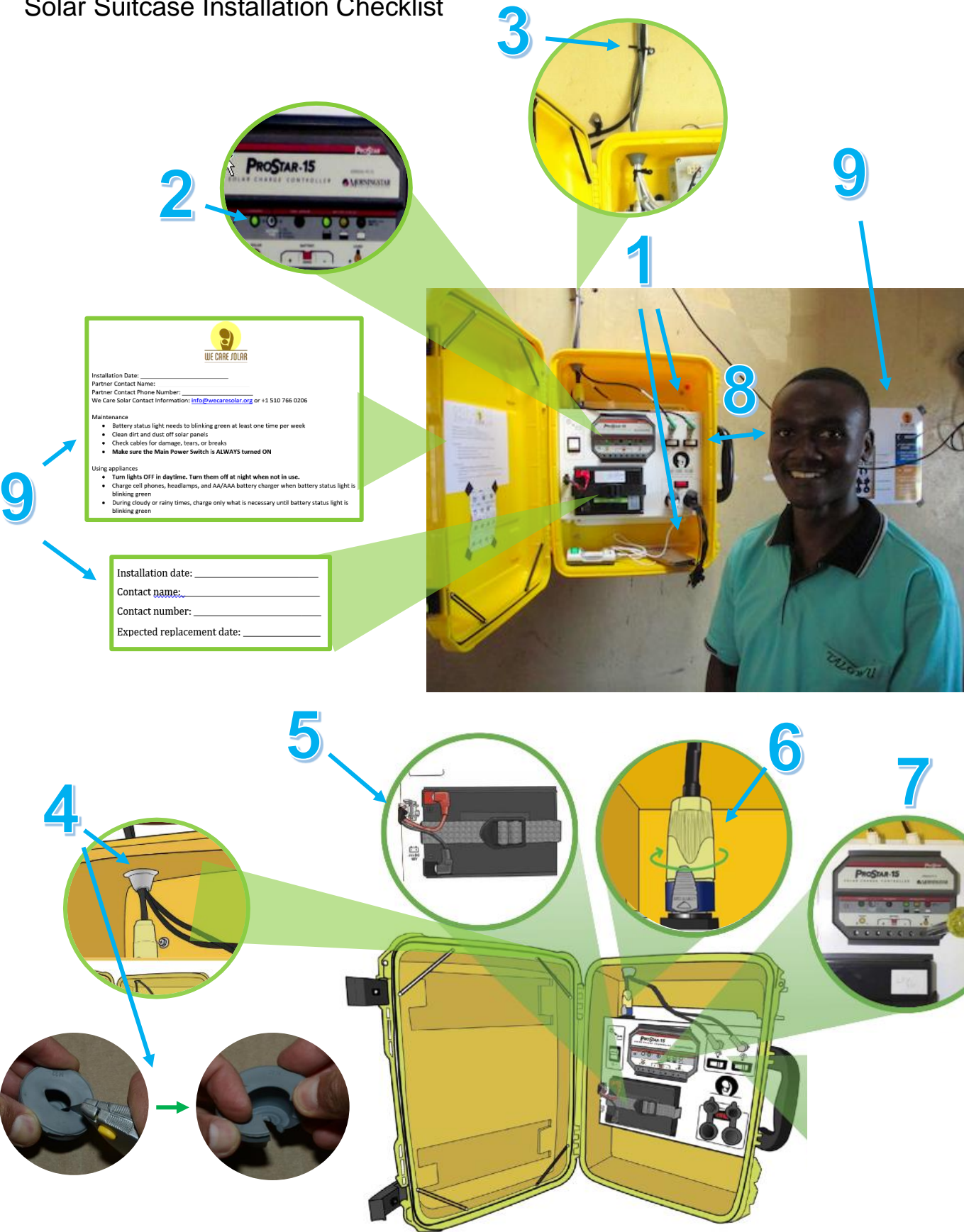


## Solar Suitcase Installation Checklist

1. The Solar Suitcase is firmly attached to the wall.
2. The solar charging light is glowing green (during the day).
3. Cables are fixed to the wall, making sure that the cables entering the Solar Suitcase are not being pulled (stress relief).
4. Grey plug is firmly inserted into hole, protecting the Solar Suitcase from dust.
5. The battery cables are properly connected (red to red, black to black) and attached to the main control board.
6. The homerun cable is firmly clicked into place with the silver tab facing forward.
7. Each charge controller screw is tight.
8. The Solar Suitcase location is accessible and at an appropriate height for midwives and staff who will use it.
9. Installation paperwork complete (see p.41).



Solar Suitcase Installation Checklist



# Installing the LED Lights

## Step 1: Determine the location for each light.

To determine essential medical activities that need light, ask the midwife the following three questions:

1. Where do you stand when conducting deliveries?
2. Where do you care for the baby after delivery?
3. Where does the mother rest after giving birth?

Most essential locations for lighting:



Delivery bed



Resuscitation table



Pre or post delivery room for patient observation

Other locations to consider (only after the above three are lit):

- Nursing station
- Receiving room
- Any other rooms that are related to maternal and newborn care
- Hallway

Location Factors to Consider:

- Light decreases intensity with distance
  - If you need a bright and focused light, place it directly in line with the area and as close as possible, or make it a mobile light so it can be brought closer if needed
  - If you are trying to illuminate a whole room, place the light in the center and as high as possible so the light reaches further
- Cable length = 10 meters
- Location of switches – make sure they are convenient for the health care workers
- Shadows – make sure that the light placement takes into account where medical staff will be standing

## Step 2: Choose a method and install the light.

Methods for installing lights:

1. Fixed installation on a ceiling or wall



2. Moveable light on a fixed line



3. Movable light attached to the wall



- Use large hooks for the roll of light cable to hang on
- Use small hooks for the light to hang on
- Attach Velcro to help keep the light cable neat

4. Moveable light hung on an IV pole or other fixture

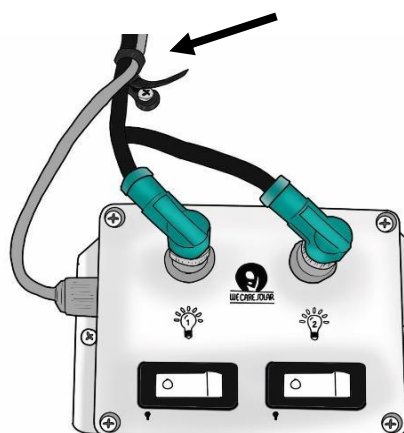




**Step 4: Install zipties to keep cables neat, out of the way of staff and off the floor.**

**Step 5: Install zipties to provide stress relief at Solar Suitcase and expansion switch box.**

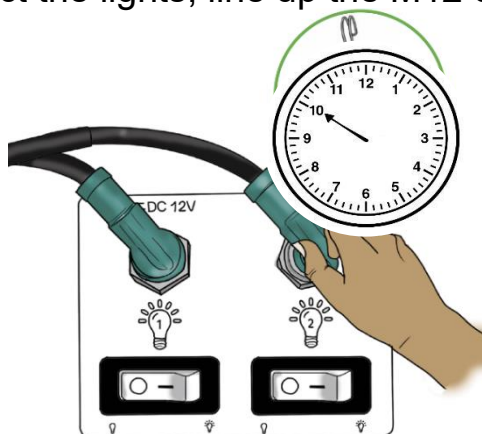
*Note: Not all Solar Suitcases come with an expansion switch box.*



expansion switch  
box

**Step 6: Connect lights to the Solar Suitcase and expansion switch box.**

To connect the lights, line up the M12 connectors at the “10 o’clock position”.



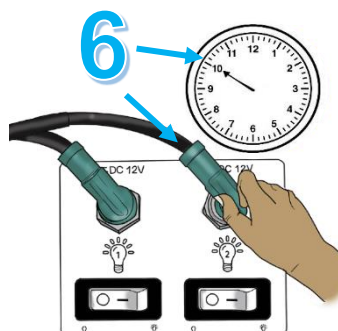
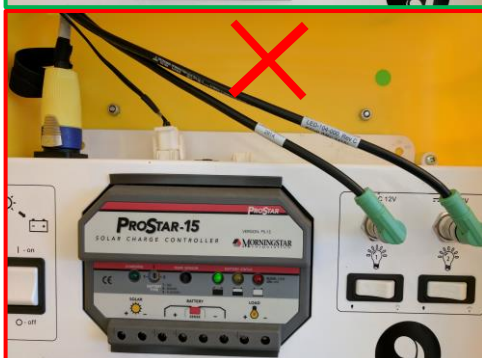
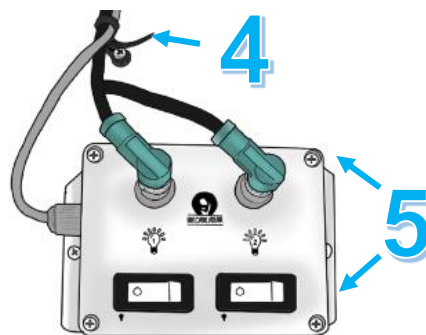
M12 CONNECTOR

**Step 7: Tighten zipties only when installation of all lights and homerun cable is complete!**



## LED Lights Installation Checklist

1. The lights are somewhere suitable for midwives, medical activities, and cable protection.
2. The cables are neatly attached to the wall with zipties and are safe from damage.
3. There is no stress at connection to light sockets and they have a comfort loop.
4. Zipties provide stress relief for cables at entry to expansion switch box (if applicable) and to the Solar Suitcase.
5. The expansion switch box is firmly attached to the wall (if applicable).
6. Light connectors are properly connected to the light sockets at the “10 o'clock” position, and threaded locking rings are tightened.
7. Hooks and lights are properly installed for fixed and mobile installations and midwives understand how to use the mobile lights.



# Installation Day – Documentation

## Installation Tracking Sheet

For each clinic where you install a Solar Suitcase, you need to record the following information:

- Solar Suitcase serial number (found on a small silver sticker affixed to the Solar Suitcase)
- Date of installation
- Name of the health facility, district and region
- Health facility main contact name and phone number
- Catchment population
- # of health facility staff trained on Solar Suitcase use and maintenance
- # of deliveries in the past month

All of this information should be recorded on an Installation Tracking Sheet (template provided by We Care Solar), on which you should record every installation. When completed, it should be sent to We Care Solar by email.


## Battery Sticker

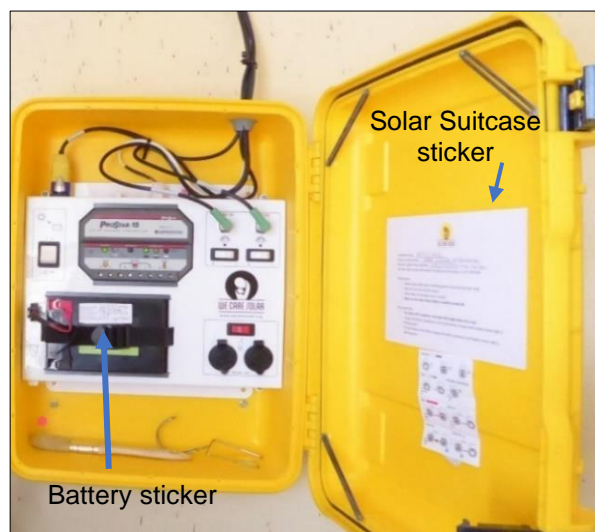
The battery sticker informs the health clinic who to contact when the main battery needs to be replaced. On the battery sticker, fill in the installation date, expected replacement date (2 years for SLA battery, 5 years for LFP), and contact information of the person responsible for main battery replacement. If you are unsure who is responsible for the main battery replacement, contact the in-country organization in charge of this program. This sticker should be affixed to the battery on the Solar Suitcase.

Installation date:	_____
Contact name:	_____
Contact number:	_____
Expected replacement date:	_____

## Solar Suitcase Sticker

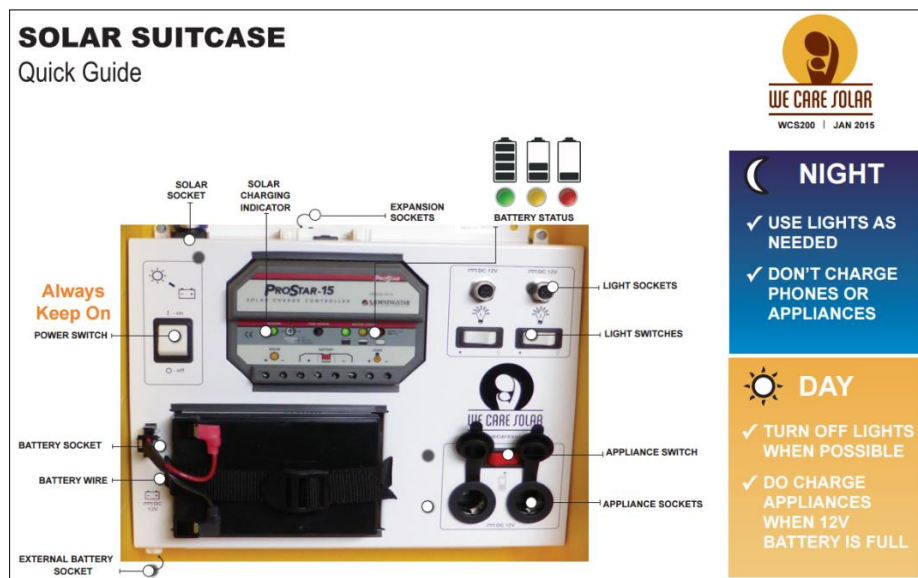
The Solar Suitcase Sticker informs the health clinic who to contact if they are experiencing any problems with the Solar Suitcase or any of its components. On the Solar Suitcase sticker, fill in the installation date and the name and contact information of the in-country organization in charge of the program. We Care Solar's contact information is also on this sticker. This sticker should be affixed to the inside of the Solar Suitcase door.


Installation Date: _____
Partner Contact Name: _____
Partner Contact Phone Number: _____
We Care Solar Contact Information: <a href="mailto:info@wecaresolar.org">info@wecaresolar.org</a> or +1 510 766 0206
<b>Maintenance</b>
<ul style="list-style-type: none"><li>• Battery status light needs to be blinking green at least one time per week</li><li>• Clean dirt and dust off solar panels</li><li>• Check cables for damage, tears, or breaks</li><li>• <b>Make sure the Main Power Switch is ALWAYS turned ON</b></li></ul>
<b>Using appliances</b>
<ul style="list-style-type: none"><li>• <b>Turn lights OFF in daytime. Turn them off at night when not in use.</b></li><li>• Charge cell phones, headlamps, and AA/AAA battery charger when battery status light is blinking green</li><li>• During cloudy or rainy times, charge only what is necessary until battery status light is blinking green</li></ul>




## Solar Suitcase Poster

The Solar Suitcase Poster comes inside the Solar Suitcase and is a quick guide for the health facility staff. It should be affixed to the wall close to the Solar Suitcase and at eye level.



## Equipment Receipt (if applicable)

The equipment receipt is for the health facility, the Ministry of Health, and/or the partner organization and is a record of the equipment that was installed and received by the health facility. This is not required by We Care Solar, but might be required by your Ministry of Health or by the in-country organization in charge of the Solar Suitcase program. It is recommended to bring two copies to the installation so that you can leave one at the health facility. A template will be provided by We Care Solar.

EQUIPMENT RECEIPT SOLAR SUITCASE		
		
<p>To: Contact Person: _____</p> <p>Name of Health Center: _____</p> <p>Location: _____</p> <p>County: _____</p> <p>Cell Phone: _____</p> <p>Date: _____</p> <p>Program: Lighting Up Tanzania _____</p>		
<p>www.wecaresolar.org</p>		
Solar Suitcase		Serial #: _____
Average Number of Deliveries per month: _____		
Description	Quantity	Notes
Solar Suitcase		
LED Medical Lights		
Satellite Box		
Solar Panel		
Battery - 12.8 Ah Lithium Ferrous Phosphate		
APPLIANCES		
Headlamps		Black Diamond
USB Adaptor/Cell Phone Adaptor		
Multi-tip Phone Charger		
Fetal Doppler		Hi Bebe portable fetal monitor
Tenergy Battery Charger		For AA and AA batteries
AA Rechargeable Batteries		Tenergy AA Batteries
Poster, User Guide, Trouble-shooting guide		Attach Poster on Wall near Suitcase

## Clinic Certificate

The clinic certificate is a certificate of participation for the healthcare workers at the clinic. At the end of installation, fill this in and present it to the clinic staff.

*CERTIFICATE OF PARTICIPATION*  
We Care Solar Suitcase Program  
May 2014  
*This certificate is presented to*

\_\_\_\_\_  
Health Facility's Name

\_\_\_\_\_  
Health Facility Location

*In recognition of agreeing to fulfill the requirements for operating, maintaining, and assessing the We Care Solar Suitcase and its impact on the*  
*Solar Suitcase Program.*

 \_\_\_\_\_  
Health Clinic Representative

\_\_\_\_\_  
Date

\_\_\_\_\_  
Program Representative

\_\_\_\_\_  
Date

## Baseline Form (if applicable)

Since We Care Solar is not able to be present at all installations, we rely on you to collect and share the information, stories, and photos about the clinic. Often, we will ask you to sit down with one of the healthcare workers and complete a questionnaire with them that asks for information such as the number of deliveries they have had per month over the last year as well as information about how they have managed to work in the dark before the Solar Suitcase was installed. If you are unsure as to whether or not you need to complete a baseline form during installation, please ask the in-country organization in charge of the Solar Suitcase program or We Care Solar directly.

## Documentation Checklist

1. Installation Tracking Sheet information, including the Solar Suitcase serial number, has been recorded.
2. Battery sticker is completed and attached to the battery.
3. Solar Suitcase sticker is completed and attached to Solar Suitcase.
4. Solar Suitcase poster is attached/displayed on wall.
5. Clinic certificate has been given to responsible person at health clinic.
6. Equipment receipt has been filled out (if applicable).
7. Baseline form has been filled out (if applicable).
8. Photos of installers, midwives, health clinic, and installations have been taken.



# Teaching Healthcare Workers How to Use the Solar Suitcase

## We Care Solar Suitcase Teaching Script

### Solar Suitcase with LFP Battery

*This script is an example of how to present all the information about the Solar Suitcase to the healthcare worker. It is meant to act as a guide. As you become familiar with the Solar Suitcase, you do not need to follow the script, but make sure that you have covered all the relevant topics described below.*

1. **INTRODUCTION:** *[Say who you are, why you are here, and your role in providing solar suitcase systems to health centers.]* For example, “My name is \_\_\_\_\_, I work [name of in-country organization], I help install Solar Suitcase systems and teach health center staff in the use of the Solar Suitcase.”

2. **OVERVIEW:** Explain briefly how the Solar Suitcase works using Solar Suitcase and poster.

**The Solar Suitcase is a complete solar electric system:**

**The Solar Panel** captures sunlight and changes it into electricity.

**The Battery** stores electricity: like a bucket storing water.

**The Home Run Cable** brings electricity from solar panel to battery.

**The Charge Controller** regulates the electricity going into and out of the battery.

**The Charge Controller** is like our “eyes” into the battery. It tells us when the battery is full.

**The Solar Suitcase** comes with Lights, Headlamps, a Cell phone charger, and a Fetal Doppler. *[Hold up each appliance.]*

**The Main Switch** turns the whole system on: **Must be on for Solar Suitcase to receive charge from the sun.** Also must be on in order to be able to use lights and charge appliances like the headlamps, cell phones, fetal Doppler.

- Allows electricity to flow from Solar Panel to Solar Suitcase, and from Battery to loads.
- **This Main Switch should always remain on**, except when you want to change the main battery, or if you are transporting the Solar Suitcase. *[Invite someone to turn the main power switch from the off position to the on position.]*

When **Main Switch** is turned on, the **Charge Controller** lights will turn ON. Now the solar suitcase is ready to be used.

**REVIEW OVERVIEW:** *[Ask questions to ensure people have understood.]*

1. What does the battery do?
2. What does the solar panel do? Does it make electricity at night?
3. What does the charge controller do?
4. When should you turn off the **Main Switch**? → Answer: Only to change the main battery

### 3. READING THE CHARGE CONTROLLER

- **Solar Charging Light:** Above the sun icon: green
  - When the solar panel is under the sun, this light will be lit green. *[Show the green light over the sun icon.]*
- **Battery Status Lights:** Above battery icon: blinking green, green, yellow, blinking red, red
  - These lights tell us when the battery is full, has energy, is nearly empty, or is empty.
  - It is important to know how full your battery is to help you know when to charge your appliances and when to save energy.

**BLINKING GREEN** battery status light – This means there is more power coming from the solar panel than the main battery can utilize. So.... There is EXTRA electricity available.

- ✓ It is a good time to charge your cell phone, your headlamps, or the AA batteries included in your Solar Suitcase for the fetal Doppler.

**GREEN** battery status light – the battery between 10% and 90% full.

- ✓ Only use lights at night.
- ✓ Only charge necessary appliances during the day.

**YELLOW** battery status light – the battery is almost empty.

- ✓ It is time to save energy. DO NOT charge up new appliances. Turn off your lights if they are not needed, OR only use one light, and wait for the sun to recharge your battery.
- ✓ If you have a medical procedure and need to use a light, we recommend you use ONE light rather than BOTH of the lights.
- ✓ Get your headlamps ready.
- ✓ Turn off all your other appliances.

**RED** battery status light – the battery is empty.

- ✓ The battery is depleted and the system will automatically shut off until the battery can recharge from the solar panels.
- ✓ When this occurs, turn off the appliance and light switches so that the battery can fully recharge the next day (when there is sunlight). **Keep the Main Switch ON.**
- ✓ Wait for the battery to recharge. The battery will recharge the next day using sunlight.
- ✓ When the battery status light is green you can use the Solar Suitcase again.

#### **REVIEW CHARGE CONTROLLER *[Ask questions to ensure people have understood.]***

1. What do the different color lights indicate? → Answer: Blinking green – there is extra power; Green – battery is 10-90% full; Yellow – battery is getting close to empty; Red – battery is empty.
2. How do you know when it is ok to charge appliances? → Answer: When it is sunny and the battery light is blinking green or green.
3. How can you tell that the solar panel is properly connected? → Answer: When the green charging light on the charge controller is lit.

## 4. USING THE SYSTEM

### a. USING THE SYSTEM during the NIGHT:

- The main function of Solar Suitcase is to provide lighting for medical procedures at night.
- **The Main Battery has a LIMITED amount of energy**, and is the only source of energy at night. A fully charged battery will keep the lights on all night.
- **Night is the time to use medical lights.**
  - Use the lights when you need them.
  - Each light has its own switch.
  - Only use one light per room when you are not treating patients.
  - Turn both lights off when they are not needed.
- *DO NOT* charge your cell phone or rechargeable batteries at night, unless there is an emergency. *[Refer to poster. Show that section. Have the entire group read this out loud.]*
- You may *use* appliances at night, however the batteries should be *charged* during the day.

### b. USING THE SYTEM during the DAY:

- When it is **daytime**, make sure to TURN OFF your lights, unless needed for medical procedures.
- When the green battery status light is flashing you can use the Solar Suitcase to charge cell phones, the headlamps and rechargeable batteries. When the light is flashing green: There is extra energy, and on a sunny day, the Solar Suitcase can charge several phones and appliances.

### REVIEW USING THE SYSTEM: *[Ask questions to ensure people have understood.]*

1. Should you charge cell phone at night? → Answer: No, unless needed for emergency.
2. Should I leave lights on all the time if battery is full? → Answer: No, use the lights when needed. Turn off when not needed.

## 5. APPLIANCES

### a. Appliances- **CHARGING CELL PHONES**

- *[Show how to connect cell phone to suitcase with USB adapter.]*
- Charge only ONE cell phone at a time on the multi-tip phone charger.
- Make sure USB adapter is pushed all the way into the socket.
- *[Ask for volunteers to charge their phone.]*
- The **Red Appliance Switch** turns on both power sockets on bottom of the Solar Suitcase.
- If you cannot find the right attachment for your particular cell phone, or if the cell phone adaptor breaks, you can use any cell phone charger that comes with a car charger plug. These can be purchased locally.
- Turn OFF the Red Switch when you don't need to charge any device or batteries.

**b. Appliances- USING THE HEADLAMPS**

- There are two orange headlamps.
- These are special headlamps because they can be charged just like a cell phone.
- First, make sure to place the USB adapter into the appliance socket and turn on the Red Appliance switch.
- To charge the headlamp, insert the micro-USB plug into the hole under rubber stopper on the headlamp and the USB plug into the USB adapter in the appliance socket.
- When the headlamp is charging, the headlamp LED will be blinking green. When the headlamp is fully charged, the LED light on the headlamp will be solid green.
- To turn on headlamp: push the button on top. *[Show how to turn on the headlamps.]*
- Adjust the beam of the light like this. *[Show how to adjust where the light beam directs by swiveling the headlamps. Also, show the different light settings and how to hold down the button and dim the lights to conserve energy and make the batteries last longer]*
- *[Have students practice]*

**c. Appliances - USING THE AA/AAA BATTERY CHARGER.**

- AA/AAA battery charger will charge RECHARGABLE AA and AAA batteries.
  - RECHARGABLE AA batteries are included in the Solar Suitcase for the fetal Doppler.
  - The charger CANNOT be used with single-use batteries. If you place single-use batteries into the battery charger, the charger will break.
  - Only use the rechargeable batteries provided with the Solar Suitcase in your AA/AAA battery charger, or other batteries that are rechargeable.
  - Charge the batteries in “families”, meaning they get charged and discharged together.
  - These batteries will power your fetal Doppler and other small devices.
- How to charge: place the positive side of the batteries in the positive side of the charger.
- Mark the positive side of the charger with a + sign.
- We included AA rechargeable batteries. The small white tab on the battery charger needs to be in the upright position to accommodate the AA batteries.
- *[Have volunteers demonstrate how to put in batteries in front of whole class.]*
- During the daytime, you CAN charge a phone and the rechargeable battery at the same time.
- If you run out of rechargeable batteries, the fetal Doppler can use single-use batteries. However, you cannot re-charge the single-use batteries in the Battery Charger. **DON'T PUT SINGLE-USE BATTERIES IN BATTERY CHARGER.**
- **ONLY RECHARGE BATTERIES ON SUNNY DAYS WHEN THE MAIN SOLAR SUITCASE BATTERY IS FULL!!!!!!**



d. Appliances- **USING THE FETAL DOPPLER**

- You can listen to a fetal heart beat by placing the fetal Doppler probe on the mother's abdomen where you think the baby's heart is.
  - Note: It is best to palpate the uterus FIRST and identify where the fetal ribcage should be, before trying to find the heart beat. Once you think you have identified the fetal back, **hold the fetal Doppler still in a single position to allow it to detect the heart beat.** If you need to adjust the position, do this slowly and allow time for the machine to detect the heart beat in the next position. The sound waves from the fetal Doppler bounce off the heart beat and this takes time.
- If your Solar Suitcase includes a fetal Doppler, it will use Rechargeable AA batteries included with the Solar Suitcase.
  - The batteries go in the back of the fetal Doppler.
  - Make sure they are placed correctly: positive to positive, negative to negative
  - The batteries that come with the Solar Suitcase are RECHARGEABLE.
- Once the fetal Doppler has fully charged batteries, turn it on with the switch on the side. *[Demonstrate turning on the fetal Doppler.]*
  - The switch on the side controls the volume.
  - When you are finished using the fetal Doppler, turn it off – listen for a \*click.
- The fetal Doppler **only works with a lubricant on the mother's skin.**
  - You can use the gel in the case.
  - **If you run out of gel you can use any vegetable oil. Water does not conduct the sound well, and should not be used.**
- Ask the midwife to palpate the mother.
  - Identify the position of the fetus, and estimate the position of the fetal thorax.
  - Place gel or oil on the mother's skin close to where you think the fetal heart is.
  - Turn on the fetal Doppler, and hold the probe against the mother's skin, in the direction of the fetal heart.
  - Hold the machine still until you hear a sound. If you can't hear the heart beat, gently adjust the angle of the probe in another direction and wait again. Don't slide the probe around.
- Understanding the fetal Doppler display:
  - The fetal Doppler has a digital display that will show you the heart beat. You must see a solid black heart in the display to be receiving an accurate heart rate reading.
  - The fetal heart rate is normally between 120 and 160 beats per minute. IF the heart beat is less than 120 or more than 160, the baby may be in danger.
  - If the heart beat is less than 100, it may be the mother's heart beat. To confirm whether you are hearing the mother, check her wrist pulse with your hand while listening to the fetal heart rate.

**REVIEW APPLIANCES [Ask questions to ensure people have understood.]**

1. When can you charge your phone? → Answer: When the battery is full.
2. How do you know if battery is full? → Answer: Look for blinking green light on Charge Controller.
3. Should you charge rechargeable batteries at night? → Answer: No. (Why not?)
4. What should you do if you run out of gel that comes with Solar Suitcase? → Answer: You can use vegetable oil. (Can you use water? → Answer: No).
5. Can you recharge single-use batteries in the battery charger? → Answer: No.
6. When is the best time to charge cell phones? → Answer: During the day.
7. Should the lights stay on all the time? → Answer: No.

## OVERALL REVIEW

**ONE** - Make sure that the solar panels have unshaded sunlight for at least five hours a day. You can leave the solar panels out in the rain and leave it out on cloudy days. Make sure your panels are clean – rinse them with water when they get dirty (but only if it is safe to do so). Do not climb on roof unless you are trained to do so.

**TWO** – Make sure that you ALWAYS LEAVE THE **MAIN POWER SWITCH ON**. This switch will turn on your solar panels and battery. If it is off, you cannot use the Solar Suitcase and the battery cannot charge from the sun.

**THREE** – At night time, only use the Solar Suitcase for lighting and do NOT charge other appliances. (If there is an emergency and you need to call for help, you can charge your cell phone anytime you need). In the day time, turn OFF the lights.

**FOUR** – During the day, you can charge your cell phones, headlamps, and AA batteries for the Doppler, when your battery is full. Your battery is full when the battery status light is blinking green.

**FIVE** – If you have questions, refer to the manual and poster that is included with the Solar Suitcase or call your local technician that installed the Solar Suitcase.

## 6. GROUP PRACTICE FIXING COMMON PROBLEMS

1. First: Start with the main power switch on and both lights on.
2. Second: Everyone cover your eyes until I say "open."
3. Third: Change something on the Solar Suitcase so it does not work (see options below).
4. Fourth: Invite people to open their eyes and choose a volunteer to come up and "solve" the problem with everyone watching.

### Options for changing something on the Solar Suitcase so it does not work:

- Turn off the light switch ~ Have them figure out that they just need to turn switch on again.
- Turn off Main Switch ~ Have them figure out that the Main Switch needs to be turned ON to make lights work.
- Unplug the Battery Plug ~ Have them figure out that they need to plug in Battery Plug for system to work.
- Remove the red slip-on battery connector from the positive terminal of the Battery ~ They will need to slip it back on for the system to work.
- Partially unscrew and partially unplug one of the Light Connectors ~ They will need to plug it back in and screw it tight again.
- Partially disconnect the Home Run Cable Plug (blue and yellow end) from top of Main Control Board and see if they notice that no solar amps are coming in and that the charging light is OFF ~ They will need to turn it so it will click back into place.
- Partially plug in the plug in the battery charger, but not enough that it makes the electrical connection ~ They will need to plug it in all the way.
- Turn OFF the appliance switch (red) ~ They will need to turn it on for the battery charger to function.

# Teaching Tips

## Teaching Preparation

- Get the right people in the room – all maternity staff, watchman, and staff in charge of the facility
- Pick a time that is convenient for them and set expectations about how long it will take (approximately 45 minutes)
- Be prepared – set up the Solar Suitcase and appliances in advance
- Don't be afraid to ask people that are not volunteering to participate

## Teaching Tips

- Language – speak slowly and clearly – especially if you are speaking to students in a language that is not their mother tongue. If you need to use a translator it will take more time.
- Your goal is students' understanding; It is not a performance, but an exchange. Encourage interaction and ask students to try out the system and explain back to you what they understood.
- Pause frequently and check in with students to see if they are following.
- Review along the way – before you switch to a new topic you might want to repeat the key messages.
- Reinforce reasons for learning.
  - Proper usage will extend the life of the Solar Suitcase.
  - Proper usage ensures that midwives will have light when it is most needed.
- Identify the key users – usually the midwives and maternity nursing staff.
  - Encourage them to teach other users especially if turnover is high in the clinic.
  - Use the checklist to test the understanding of key elements.



## User Comprehension Checklist

\*Make sure a minimum of 3 people at the facility are well trained.

Ask key users the following questions to demonstrate their knowledge of how to use the Solar Suitcase:

1. Where is the main switch? When do you turn it off?
2. What do the different lights mean on the charge controller? (Make sure they know the difference between the solar charging light and the battery status light, as well as what to do when the battery status light is blinking green, green, yellow, and red.)
3. Where are the light switches? When should you use the lights?
4. Where is the appliance switch? When should you charge appliances?
5. Show me how to use the battery charger. What kinds of batteries can you charge in the battery charger? What does it mean to charge the batteries in “families”?
6. When can you charge your phone? How many phones can you charge at one time with the multi-tip phone charger?
7. Show me how to use the fetal Doppler. Should you turn it off when it is not in use? What kinds of lubricants can you use with the fetal Doppler?
8. Show me how to use the headlamp. How do you charge the headlamp?
9. Who do you contact if you have a problem with the Solar Suitcase? Who do you contact when the main battery needs to be replaced?





# Solar Suitcase Repair and Maintenance



## Overview

The Solar Suitcases are built with the highest quality parts. When properly installed, used, and serviced, and with one LFP battery replacement every 5 years, the Solar Suitcases and panels (excluding appliances) can last 10+ years. Maintenance and repair are minimal.

## Main Battery Replacement

The main batteries, which are lithium ferrous phosphate (LFP), will need to be replaced after 5 years. Sealed lead acid (SLA) batteries will need to be replaced after 2 years. You will know when the main battery needs replacement when you are sure the solar panel is receiving sunlight but the LED lights do not stay on all night. You can also check the battery sticker for the date of installation to know when it needs to be replaced. We recommend a 12V, 12Ah LFP battery. The Solar Suitcases are also compatible with 12V, 12-14 Ah SLA batteries.

## Solar Panels

Panels are built to last for 10+ years and are unlikely to need repair. Refer to the section in this guide called *Troubleshooting* if the Solar Suitcase is not producing any power.

## Appliance Anticipated Lifespan

Appliances that come with the Solar Suitcase include: two headlamps, one rechargeable battery charger, one 2-slot USB adaptor, one 10-in-1 USB phone charger, and one fetal Doppler. All of these appliances have a limited life span, and will need to be replaced. Replacements can be found in the We Care Solar Service Kits (see section in this manual titled *We Care Solar Service Kits*). If there are none left in the service kits, many of these items can be purchased locally.

## Maintenance

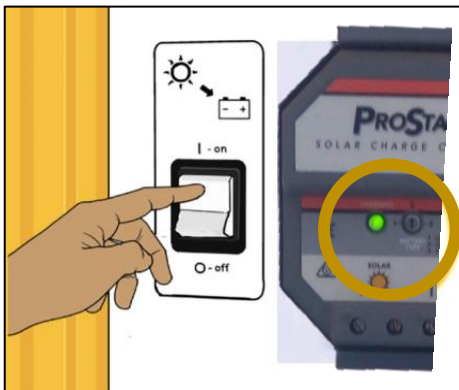
While the Solar Suitcases require little maintenance and repair, we strongly suggest calling or visiting the facilities every six to twelve months to ensure everything is working properly. Although health workers will have been trained during installation on how to properly use the Solar Suitcase, some users need refresher training and new health workers may lack information on how to use the Solar Suitcase. Users may also be reluctant to report any problems. Following up to ensure the system is working properly is the best way to reinforce and check proper usage of the Solar Suitcase.

# Troubleshooting

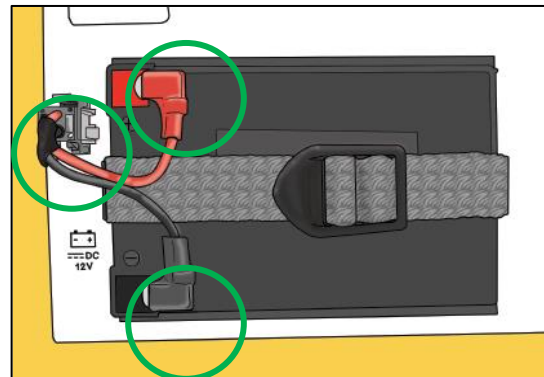
<i>Description of Issue</i>	<i>Issue</i>	<i>Page</i>
No appliances or lights work No lights on the charge controller display	→ <b>A. System is not functioning</b>	54-55
Lights turn out in the middle of the night Lights turn out earlier than they used to	→ <b>B. System performance is poor</b>	55-56
One or both lights do not work at all	→ <b>C. LED light is not functioning</b>	57
One appliance socket is not working One specific appliance is not working	→ <b>D. Appliance is not functioning</b>	57-59

## A. System is not functioning

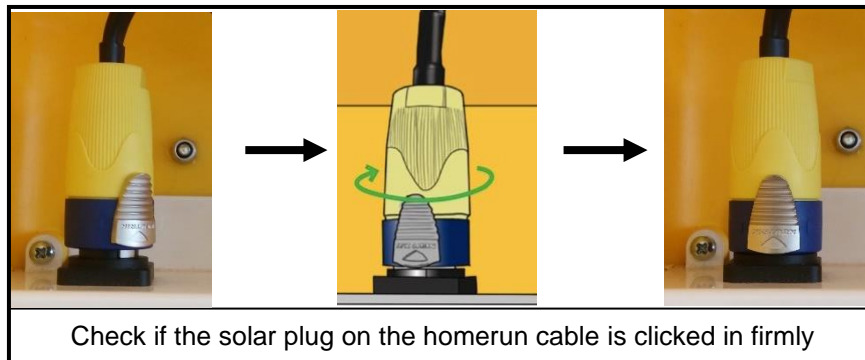
### Step 1: Examine the Solar Suitcase



Make sure the main power switch is on and green solar charging light is lit when the sun is out

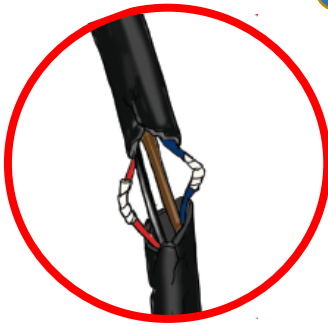


Check if the battery terminals are firmly connected.



Check if the solar plug on the homerun cable is clicked in firmly

## Step 2: Check the homerun cable for cuts



If the wire inside is severely damaged or you can see the metal wire in the cable, wrap electrical tape around each separate negative and positive wire within the larger wire, then wrap tape around the whole bundle.

Or call a technician.



NOTE: If the wire is only damaged on the black casing, wrap with electrical tape to prevent it from causing a problem.



## B. System performance is poor

**Step 1: Check how old the battery is.** An LFP battery lasts for 5 years and an SLA battery lasts for 2 years. If the battery is old, it will need to be replaced.

There is a sticker on the battery that tells you how old it is and when it will likely need to be replaced

Installation date: 19/06/2017  
Contact name: Joseph Krü  
Contact number: 088 769 473  
Expected replacement date: 19/6/2022

**Step 2: Make sure the system is not being overused during the day. Use the battery status lights to guide proper usage.**



**Battery is full**  
– This is a good time to charge appliances.



**Battery is between 10% and 90% charged –**  
You may charge appliances on sunny days.



**Battery is getting very low – 10% or less.**  
Conserve energy. Turn off all lights and discontinue



**Battery is very low and power will soon turn off.** Turn off all light switches and appliances. Wait until next sunny day for battery to recharge.



### Step 3: Now check what is causing the lack of energy!



**If bad weather**



**Use light at night only;  
don't charge appliances**



**If there is shade**



**Cut branch, or move the solar panels  
to an area of the roof that is not  
shaded.**



**If solar panel is dirty**



**Wash panel with soft cloth**

If there is sunshine but no green light above the sun icon (the solar charging light), it means that there is a problem with the panel or homerun cable. After you have reviewed all 3 steps in this section, return to the previous section and complete Step 1: Examine the Solar Suitcase and Step 2: Check the homerun cable.



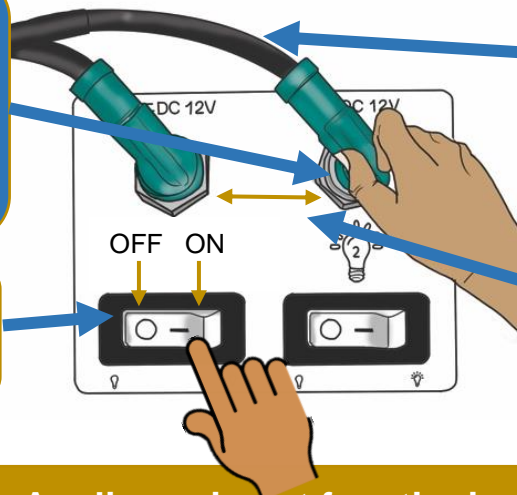
### C. LED light is not functioning

**Step 1: Check light socket connections are inserted correctly and the locking nut is firm**

**Step 2: Check the light switch is on**

**Step 3: Check the light cable for damage**

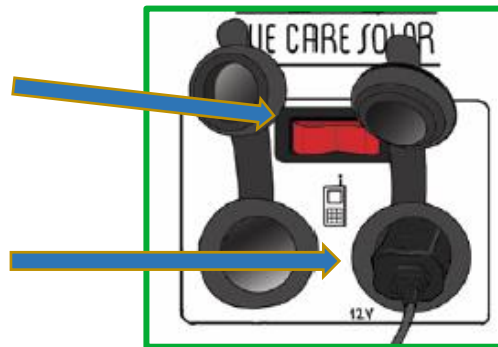
**Step 4: Try switching light connections to see if it is the light, or the socket that is faulty**



### C. Appliance is not functioning

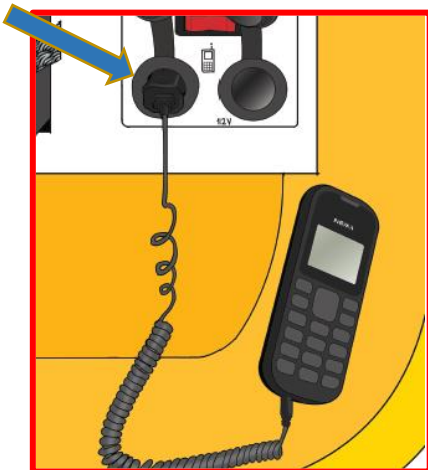
**Step 1: Make sure the red appliance switch is in the ON position**

**Step 2: Make sure the USB adapter is fully inserted into the socket**

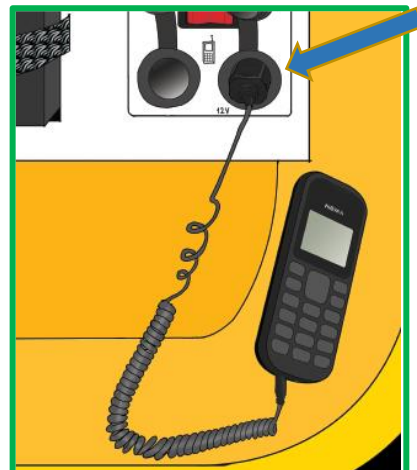


**Step 3: Make sure both sockets are functioning**

If socket 1 fails to charge.

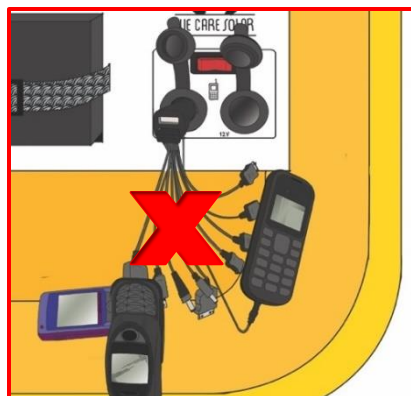


Try to connect to socket 2.



If you have done steps 1-3 on the previous page and the appliance still isn't working, follow the instructions below for that appliance (mobile phone charger, headlamp, or fetal Doppler).

## C1. Mobile phone is not charging



Do not charge multiple phones with the multi-tip phone charger. If the multi-tip phone charger is used with many phones, it can easily fail.

Change to another charger or purchase a new charger.



If that doesn't work, it could also be that the battery in the phone doesn't work and you need to replace it.



## C2. The headlamp is not working

### Step 1: Check if the headlamp is charging properly

When charging properly, the charging light should be flashing **green**.



If the light is any other color than green, it is not charging.

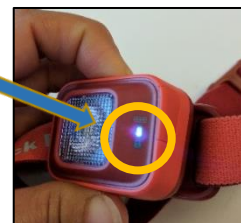
### Step 2: Check that the headlamp is being used correctly

Review instructions on how to use the headlamp. A few reminders:

Make sure the headlamp is switched on properly. Switch off headlamp after use.



If the charging light is blinking blue when you try to turn it on, it means the headlamp is locked. To unlock it, hold down the main (top) button until the blue light turns off and main light turns on (about 4 seconds).

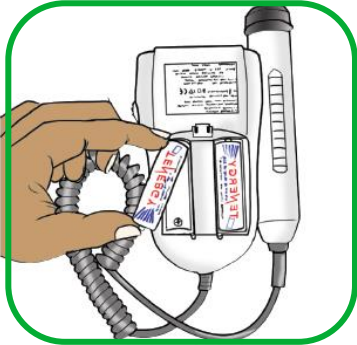


If it still doesn't work, it may need to be replaced. Contact the organization that delivered the Solar Suitcase to obtain information on where to get a replacement.

### C3. Fetal Doppler is not working

Review instructions on how to use the fetal Doppler. If that doesn't solve the problem, follow the steps below:

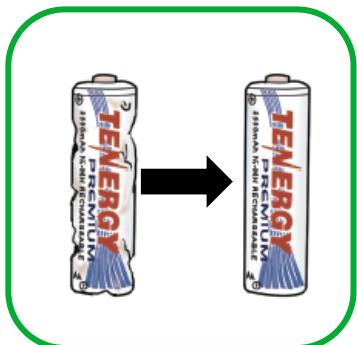
#### Step 1: Check the batteries



Make sure the batteries are inserted correctly (+ to + and – to –)



Make sure the batteries are fully charged.



Replace batteries if they are damaged or old.

#### Step 2: Check the usage



Be sure the switch is turned on to use. Turn off when done.



Make sure it is being used correctly.



Always use gel or oil on the tip. If you are out of gel, use KY jelly or vegetable oil.



## We Care Solar Service Kits

- To be used for spare parts and accessories that are difficult to get in-country
- Generally 1 service kit for every 10 Solar Suitcases
- Store kits in the District where Solar Suitcases are installed (not in capital or regional headquarters)
- Important to determine in advance who will manage distribution and replacement

Included in every kit:

2 headlamps



2 LED lights



1 internal battery cable



1 AA/AAA rechargeable battery charger



1 2-slot USB adapter with micro-USB cable



4 AA rechargeable batteries



2 multi-tip phone chargers



1 homerun cable



1 hardware mounting kit





# Warranty

## What to do when the Solar Suitcase is not working well:

- Review troubleshooting guide.
- If you are unable to fix the problem with this information, call the organization that installed the Solar Suitcase. (Look at the number written on a sticker on the inside of the Solar Suitcase door.)
- If you are unable to reach anybody locally, you can also call or write directly to We Care Solar:

**We Care Solar**  
**[www.wecaresolar.org](http://www.wecaresolar.org)**  
**+1-510-766-0206**  
**[info@wecaresolar.org](mailto:info@wecaresolar.org)**

## Warranty

We Care Solar provides a limited warranty for two years on the base system. The base system includes: chassis, charge controller, LED lights, and solar panels (if purchased from We Care Solar). All warranty claims are dependent on proper installation and usage.

No appliances are covered under warranty. Appliances include: phone charging cables, USB adapter, battery charger, headlamp, and fetal Doppler.



# Solar Suitcase Installation Master Checklist

<b>A INSTALLATION DAY PREPARATION CHECKLIST</b>	
<i>When packing up your equipment in the car to drive to an installation, make sure you have the following equipment:</i>	
	Solar Suitcase + 1 extra for teaching health facility staff – Make sure that accessories, installation hardware, user manual, and poster are inside the Suitcase
	Solar Panel(s) + 1 extra in case of breakage
	Installation paperwork (stickers, tracking sheet, receipt, certificates, baseline form, etc.)
	Toolbag – Make sure the toolbag includes all the necessary tools for installation
	Drills – Make sure the drill batteries are charged and you bring the charger
	Ladder for reaching the roof (+ step ladder for installing lights indoors if you have one)
	Water and snacks for during installation
	Camera for taking photos at installation
<b>B SOLAR PANEL INSTALLATION CHECKLIST</b>	
	Solar panel has best access to sunshine and NO shade
	Solar panel is securely attached to roof beams
	All holes are sealed with silicone
	Solar panel frame looks straight and panel is not twisted
	Homerun cable is protected from sharp edges with conduit
	Homerun cable has stress relief and a drip loop
<b>C SOLAR SUITCASE INSTALLATION CHECKLIST</b>	
	The Solar Suitcase is firmly attached to the wall
	The Solar Suitcase location is accessible for: midwives, medical activities, security, etc.
	Door opens conveniently. Solar Suitcase and light switches are reachable
	The battery cables are properly connected
	The homerun cable is firmly clicked into place with the silver tab facing forward
	The solar charging light is glowing green (during the day)
	Charge controller screws are tight and the battery selector is on “2” for sealed
	Grey plug is firmly inserted into hole, protecting the Solar Suitcase from dust
	Stress relief is provided for all cables entering the Solar Suitcase
<b>D LED LIGHTS INSTALLATION CHECKLIST</b>	
	The lights are somewhere suitable for midwives, medical activities, and cable protection
	The wires are neatly attached to the wall with zipties and cables are safe from damage
	Zipties provide stress relief for cables at entry to expansion switch box (if applicable) and to the Solar Suitcase
	There is no stress at connection to light sockets and they have a comfort loop
	Hooks and lights are properly installed for fixed and mobile installations and midwives understand how to use the mobile lights
	If applicable, the expansion switch box is firmly attached to the wall
	Light connectors are properly connected to the light sockets at the “10 o’clock” position

<b>E</b>	<b>DOCUMENTATION CHECKLIST</b>
	Installation Tracking Sheet information, including the Solar Suitcase serial number, has been recorded
	Battery sticker is completed and attached to the battery
	Solar Suitcase sticker is completed and attached to the Solar Suitcase
	Solar Suitcase poster is attached/displayed on the wall
	Clinic certificate has been given to responsible person at health clinic
	Equipment receipt has been filled out (if applicable)
	Baseline form has been filled out (if applicable)
	Photos of installers, midwives, health clinic, and installations have been taken
<b>F</b>	<b>USER COMPREHENSION CHECKLIST</b>
	A minimum of 3 people at the facility are well trained
	<i>Ask key users the following questions to demonstrate their knowledge of how to use the Solar Suitcase:</i>
	Where is the main switch? Should it always be on?
	What do the different lights mean on the charge controller? <i>(Make sure they know the difference between the solar charging light and the battery status light, as well as what to do when the battery status light is blinking green, green, yellow, and red)</i>
	Where are the light switches? When should you use the lights?
	Where is the appliance switch? When should you charge appliances?
	Show me how to use the battery charger. What kinds of batteries can you charge in the battery charger? What does it mean to charge the batteries in “families”?
	When can you charge your phone? How many phones can you charge at one time with the multi-tip phone charger?
	Show me how to use the fetal Doppler. Should you turn it off when it is not in use? What kinds of lubricants can you use with the fetal Doppler?
	Show me how to use the headlamp. How do you charge the headlamp?
	Who do you contact if you have a problem with the Solar Suitcase? Who do you contact when the main battery needs to be replaced?
<b>G</b>	<b>OVERALL INSTALLATION COMPLETE – please do one final check to see if...</b>
	System is functioning well – Homerun cable is properly connected “clicked in” and solar charging light is lit
	Lights – turn on and confirm that the plugs are inserted properly into the sockets
	Cables are neatly and firmly attached to the walls with zipties
	Appliances are stored in a secure location and someone at the health facility is responsible for them
	Battery connection is solid
	Facility is clean and left in the same order as when you arrived
	Tools are organized and packed

# Checklist of Skills for Installing, Using, Maintaining the Solar Suitcase

Name \_\_\_\_\_

*Instruction: Please review this list of skills. In the column on the left rate your proficiency on a scale of 1: needs improvement, 2: proficient, and 3: mastery.*

1,2, or 3	<b>USING THE SOLAR SUITCASE</b>
	Knows proper procedure for initially turning on Solar Suitcase
	Knows that the main switch stays in the on position except to change a battery, or to “re-boot” charge controller
	Knows how to look at the charge controller to know that the system is on.
	Knows how to look at the charge controller and read the solar charging light.
	Knows how to look at the charge controller and read battery status lights.
	Knows that it is best to charge AAA/AA batteries, headlamps and cell phones during the daytime when the battery status light is green or flashing green
	Knows to conserve power when battery status light is yellow or flashing red. Knows to conserve power if it is a rainy day.
	Knows how to conserve power by not charging appliances (phones, AAA battery charger).
	Knows to minimize use of light to conserve power: e.g. May use one light alone when needed, and add second light ONLY when necessary for specific procedures.
	Knows to turn off lights when not in use.
	Knows to turn off lights during daytime, unless light is needed for exam or other procedure.
	Knows to turn on red appliance switch to charge appliances.
	Knows that you can charge TWO appliances at a time
	AA/AAA Battery Charger:
	<ul style="list-style-type: none"> <li>Knows how to use the AAA/AA battery charger</li> </ul>
	<ul style="list-style-type: none"> <li>Knows not to use single-use batteries in charger, only rechargeable batteries.</li> </ul>
	<ul style="list-style-type: none"> <li>Knows to orient batteries positive-to-positive location in charger.</li> </ul>
	<ul style="list-style-type: none"> <li>Knows how to use batteries in stable groupings (families, use marker or tape with same colors) to optimize long-term performance.</li> </ul>
	Headlamps:
	<ul style="list-style-type: none"> <li>Knows how to use the headlamp.</li> </ul>
	<ul style="list-style-type: none"> <li>Knows to use the micro-USB charging cable for routine charging, and knows how to understand the charging light</li> </ul>
	<ul style="list-style-type: none"> <li>Knows how to turn on and off the lights.</li> </ul>
	<ul style="list-style-type: none"> <li>Knows how to dim the lights to conserve battery power.</li> </ul>



	Fetal Doppler:
	<ul style="list-style-type: none"> <li>Knows how to place rechargeable AA batteries correctly in Doppler</li> </ul>
	<ul style="list-style-type: none"> <li>Knows that the Doppler should be turned on when it is time to use, turn off when not in use.</li> </ul>
	<ul style="list-style-type: none"> <li>Knows that the Doppler uses two rechargeable AA batteries, which can be recharged by the battery charger.</li> </ul>
	<ul style="list-style-type: none"> <li>Knows how to teach midwives to identify position of fetus, and estimate location of heart before using the Doppler</li> </ul>
	<ul style="list-style-type: none"> <li>Knows that ultrasound gel (cooking oil or KY jelly) are needed for use of the Doppler</li> </ul>
	<ul style="list-style-type: none"> <li>Knows to instruct midwife to place the Doppler with gel on patient's skin over the location of the fetal heart</li> </ul>
	<ul style="list-style-type: none"> <li>Knows how to turn on the Doppler, increase volume if needed, and hold still over the fetal heart to listen properly. Knows to wait for fetal heart rate to be heard, and that the black heart will show on the monitor.</li> </ul>
	<ul style="list-style-type: none"> <li>Knows that the heart rate should be recorded by midwives and the normal range is between 120 and 160.</li> </ul>
	Charging Cell Phones:
	<ul style="list-style-type: none"> <li>Knows how to plug in USB adapter securely in 12V DC car charging ports.</li> </ul>
	<ul style="list-style-type: none"> <li>Knows how to use the multi-tip USB phone charger.</li> </ul>
	<ul style="list-style-type: none"> <li>Knows to only plug one cell phone at a time into the multi-tip charger.</li> </ul>
	<ul style="list-style-type: none"> <li>Knows the option to purchase a separate car charger for individual phones and place in the appliance socket</li> </ul>
	<ul style="list-style-type: none"> <li>Knows that the USB charger can be used to charge two phones at once; even though multi-tip phone charger only can charge one at a time.</li> </ul>
I, 2, or 3	<b>INSTALLING SOLAR PANELS</b>
	Knows how to use a ladder safely to get onto a roof
	Knows ALL the correct tools for a roof installation (drill, etc.)
	Knows how to locate the support rafters or beams in a roof to step safely on roof and to make for a secure mounting of the panel
	Knows correct parts for an installation (e.g. "L" brackets for conventional modules, screws of proper type and length, roof sealant such as silicon, etc.)
	Knows to locate solar panel in an area that has good access to the sun from 10 am to 4 pm and <b>without shade for the whole day</b>
	Knows to locate solar panel in a place in which at least two of the mounting screws can meet roof framing or other structural material (Best if all 4 L-bracket screws reach framing, but at least 2 if no other option). Knows the option of using extender metal.
	Knows how to adjust L brackets to reach roof framing. If not able to reach 2 rafters, knows alternative method of mounting by attaching middle of solar panel to single rafter (like in video).
	Knows to locate solar panels to facilitate running the "homerun cable" into the building and to the Solar Suitcase mounted on the wall

	Knows strategies for running the homerun cable which may affect where on the roof the solar panel is placed: e.g. running cable between layers of tin roofing, <b>or under the ridge cap</b> , or around the edge of the roof and through a window, through an eve.
	Knows to create a drip loop on homerun cable before it enters the building
	Knows that the solar panel should be tilted at least 10° to shed water
	Knows how to connect and detach MC-4 connectors
	Knows how to detach blue/yellow solar plug from home run cable.
	Knows how to provide stress relief by attaching homerun cable to solar panel frame.
	Knows that when you mount a solar panel on the roof, it is important to minimize the holes made into the roof and to seal the roof to prevent leaking.
	Knows to only make holes in the peak of the corrugation
	Knows that when you run the homerun cable through the roof or around the roof edge, protect the cable from sharp edges using additional protective materials (e.g. split conduit)
	Knows how to drill through aluminum of conventional panel in a way that protects panel from damage and makes a hole for a secure bolt. Use L brackets as guide and guard.
	Knows how to assess safety of roof and knows that we should NOT attempt to mount solar panel on an unsafe roof. Knows to mount alternative ground mount structure instead.
1,2 or 3	<b>INSTALLING THE SOLAR SUITCASE</b>
	Knows there is a difference between Lead Acid and LFP battery. Knows that we use the LFP battery that lasts for five years.
	Knows where to mount a Solar Suitcase on a wall: located in reach of lights, within reach of the 11-meter homerun cable that leads to the Solar Panel. Knows to choose location that is safe and accessible.
	Knows which tools are needed for the mounting: <ul style="list-style-type: none"> <li>• Drill with concrete bit (if mounted on masonry wall, proper screw drivers and sized drill bits).</li> <li>• If access to wall with wood framing, then to locate where two bolts can go into the wood framing of the wall (typically an interior wall).</li> </ul>
	Knows to mount the Solar Suitcase level; knows how to use level
	Knows the steps to installing the suitcase on the wall: remove the control board, drill 4 holes in back of suitcase, mark 1 hole and attach suitcase, mark other 3 holes while using level. Attach suitcase using LARGER hex-head screws in plastic anchors. Reattach main control board.
	Knows to place Solar Suitcase on table if wall is not strong enough for wall mount.
	Knows how to connect battery to main control board
1,2 or 3	<b>INSTALLING THE LIGHTS</b>
	Knows to discuss lighting needs with healthcare staff, and to ask 3 questions: <ol style="list-style-type: none"> <li>1. Where do you stand when conducting deliveries?</li> <li>2. Where do you care for the baby after delivery?</li> <li>3. Where do mothers rest after giving birth?</li> </ol>

	Knows to re-run the cables for the lights through the hole in top of box for permanent installation and that light cables have comfort loop.
	Knows how to use the M12 connectors, that it is both plug and screw operation
	Knows how to consider where to mount the lights so that they reach the solar suitcase AND that they provide light where it is most useful.
	Knows several ways to attach the lights to the wall and manage the cables. You can be creative.
	Knows how to locate ceiling framing or adequate bite into ceiling material to make a secure mounting of the light
	Knows how and where to mount expansion switch box
	<p>Knows the final touches of the Solar Suitcase installation:</p> <ul style="list-style-type: none"> <li>• Install the grey plug at top of Suitcase</li> <li>• Stress relief at top of suitcase</li> <li>• Comfort loop for light cables</li> <li>• Fill in paper work (equipment receipt, certificate), battery sticker and Suitcase sticker with contact information</li> <li>• Brush out dust and debris after installation</li> <li>• Attach poster to wall</li> </ul>

Please visit <https://wecaresolar.org/resources/product-info/> for training videos on Solar Suitcase installation, use, maintenance, and repair.

Artwork in this manual courtesy of:

