

GRAINPRO® SOLAR BUBBLE DRYER™50

# INSTRUCTION MANUAL

MA4040RAD0914-10



**“A GREEN, NOT ONLY FOR  
PROFIT COMPANY”**



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## TABLE OF CONTENTS

1. INTRODUCTION .....	4
2. CHECKLIST.....	5
3. COMPONENTS .....	8
4. SPECIFICATIONS.....	8
5. ASSEMBLY AND OPERATING PROCEDURES.....	9
Site selection.....	9
Installation .....	9
Wiring connection and electrical safety for SBD50-Solar .....	13
Wiring connection and electrical safety for SBD50-Electric .....	18
Loading .....	18
Closing .....	19
Fixing wall with support loops .....	19
Ventilator management .....	19
Mixing .....	20
Unloading .....	21
6. MAINTENANCE AND CARE.....	21
Repairing punctures and other damages .....	21
Cleaning the top cover and bottom section .....	22
Body folding instruction .....	22
Battery charging, maintenance and storage.....	23
Safekeeping .....	24
Recycling.....	24
Platform installation of Rodent Guard .....	24
7. TROUBLE SHOOTING: SBD-SOLAR WIRING HARNESS.....	25
Case 1: Battery indicator status is “steady off” .....	25
Case 2: Battery indicator status is “slow flashing” .....	26
Case 3: Battery indicator status is “quick flashing” .....	27
Case 4: Solar Panel/Charge indicator is “steady off” .....	28
Case 5: Solar Panel/Charge indicator is “quick flashing” (system over voltage).....	29
Case 6: Load indicator is “steady on but there is no output” .....	30
Case 7: Load indicator is “steady off” .....	31
Case 8: Load indicator is “slowly flashing and there is no output” .....	32
Case 9: Load indicator is “quick flashing and there is no output” .....	33
Case 10: Solar charge controller is not working properly.....	34
8. FREQUENTLY ASKED QUESTIONS AND ANSWERS .....	35
9. WARRANTY CLAUSE.....	37

## 1. INTRODUCTION

The GrainPro® Solar Bubble Dryer™ 50 (SBD50) is a collapsible, tunnel-type dryer with 1.0 metric ton (1,000kg) drying capacity designed to protect the agricultural commodity from intermittent/sudden rains during drying, and to prevent spillage and contamination. Drying performance is dependent on the solar radiation, relative humidity of the ambient air, and moisture content of concerned agricultural commodity. The SBD50 consist of a transparent cover made of UV-resistant polyethylene film connected to the black reinforced PVC drying floor by a heavy-duty zipper. Through the transparent top cover, solar radiation enters the drying chamber and heats up the agricultural commodity being dried. Moisture content is then vaporized and pushed by the ventilators out from the drying chamber.

The SBD50 technology makes drying possible even during unpredictable weather conditions. It can dry grains and seeds at an average drying rate of 0.5% per hour based on paddy and corn. However, during full sunny conditions drying time is about 6 to 8 hours on a moisture content of 22% to 14%. It is a multi-crop dryer that can be used to dry paddy, corn, coffee, and others.

There are two GrainPro SBD50 commercial models, namely: SBD50-Solar which operates purely on solar energy to dry the commodity and run the ventilators. While the SBD50-Electric uses electric power from the grid to run the ventilators and solar energy to dry the commodity. There is a rake mixer that can be used in all terrain and a tube mixer (optional mixing device) which provides undulating motion during mixing operation.

### 1.1. FEATURES:

- 1.1.1. Collapsible dryer can be installed on any flat surface, a multi-commodity dryer.
- 1.1.2. Protects the commodity being dried from sudden rains, spillage, and contamination.
- 1.1.3. Protects the commodity from fowls, birds, and other animals.
- 1.1.4. Protects the commodity from unhealthy and hazardous contaminants.
- 1.1.5. Designed to address the effect of climate change.
- 1.1.6. The SBD50-Solar doesn't use fossil fuel that contributes to greenhouse gases.

### 1.2. PRODUCT GUARANTEE:

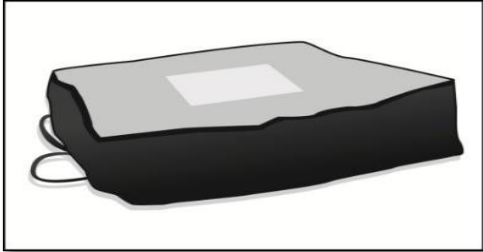
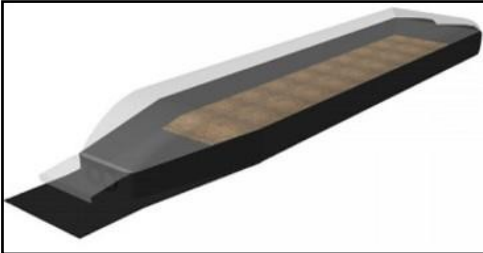
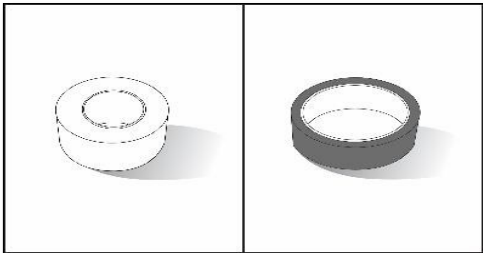
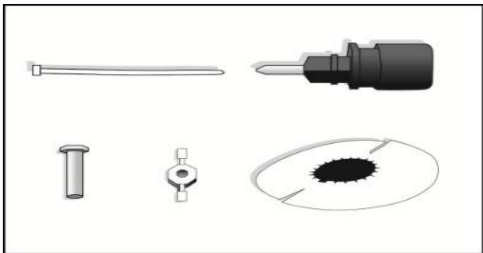


- 1.2.1. In accordance with the terms and conditions herewith, GrainPro, Inc. fully guarantees the quality of this product provided it is used according to the instructions in this manual.
- 1.2.2. Please read and understand the manual thoroughly before using the Solar Bubble Dryer50.




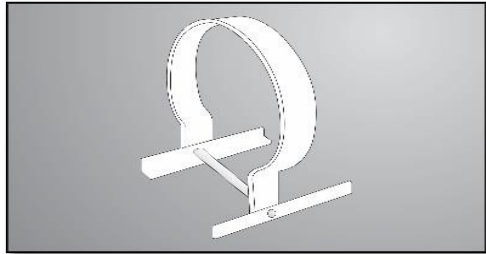
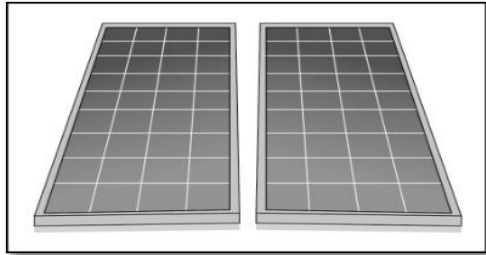
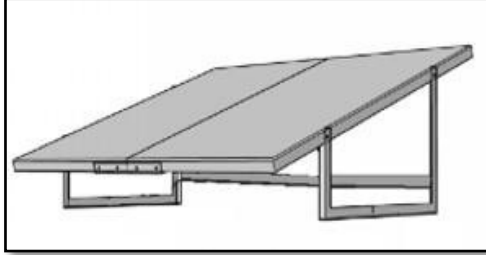
### 1.3. COMMENTS, COMPLAINTS, AND/OR CLARIFICATIONS:

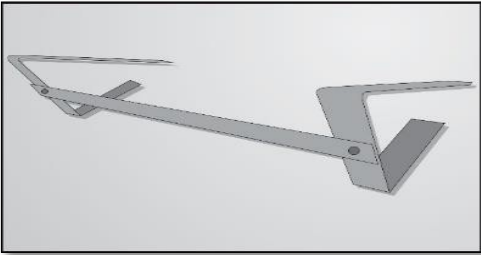

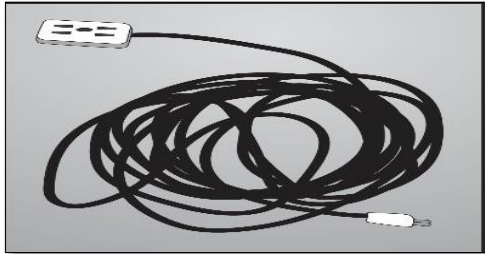

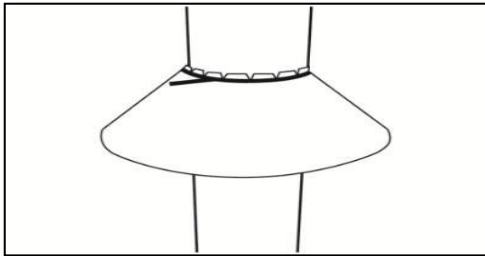
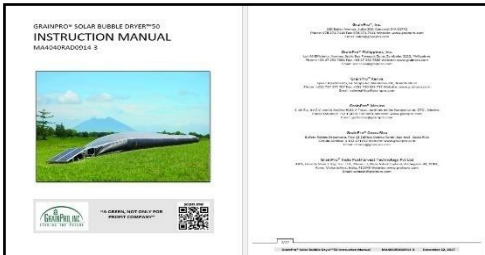
- 1.3.1. Please contact [customercare@grainpro.com](mailto:customercare@grainpro.com).
- 1.3.2. We shall be glad to answer any of your questions.

## 2. CHECKLIST

Please inspect your GrainProSBD50 package to ensure it includes the following items:

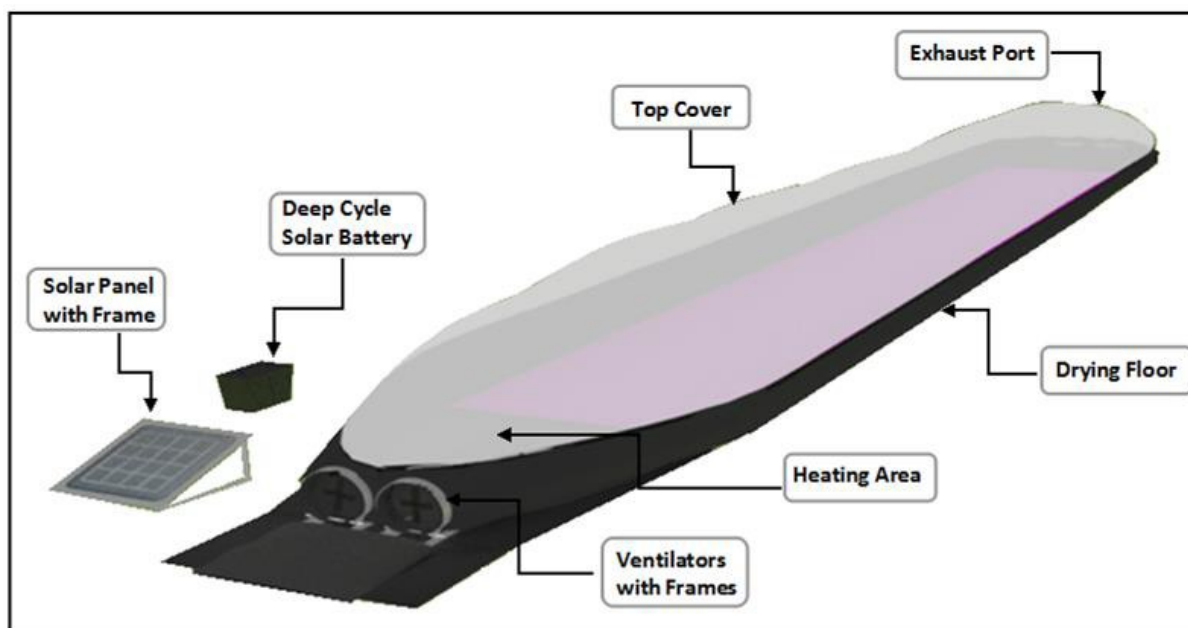
PART NAME	DESCRIPTION	IMAGE
2.1. CARRY BAG	2.1.1. Contents: a. SBD50 (Drying floor and Top cover) b. Ventilator cover	
2.2. SBD50-SOLAR OR SBD50-ELECTRIC	2.2.1. UV-resistant water proof and transparent top cover (UV-LDPE). 2.2.2. Drying floor made of black reinforced PVC (610gsm).	
2.3. REPAIR TAPE	2.3.1. PE repair tape, UV resistant and transparent- for repair/ patching of the top cover. 2.3.2. PVC duct tape, Grey- for the drying floor.	
2.4. SMALL PARTS	2.4.1. Cable ties. 2.4.2. Screw driver. 2.4.3. Bolts and winged nuts. 2.4.4. LDPE Rodent Guard.	
2.5. RAKE MIXER	2.5.1. Consists of the handle [designed in three (3) pieces joined by couplers], and the rake head with teeth. One (1) unit	
2.6. TUBE MIXER (OPTIONAL)	2.6.1. Disassembled mixing device, consists of three (3) parts, One (1) unit	

	2.6.2. Offset Box Wrench, Two (2) pieces	
2.7. AC VENTILATOR	2.7.1. 220V AC ventilators. Two (2) units for SBD50-Electric	
2.8. DC VENTILATOR	2.8.1. 12V DC ventilators. Two (2) units for SBD50-Solar	
2.9. VENTILATOR FRAME	2.9.1. Supporting aluminum clamp to hold the ventilator. Two (2) sets	
2.10. SOLAR PANELS	2.10.1. Used to convert light into electricity, 12V. Two (2) units	
2.11. SOLAR PANEL SUPPORT FRAME	2.11.1. Supporting aluminum structure for the solar panels. 2.11.2. Two (2) legs 2.11.3. Two (2) brackets 2.11.4. One (1) horizontal brace	

2.12. EXHAUST SUPPORT FRAME	2.12.1. Supporting aluminum structure for the SBD exhaust port. One (1) assembly	
2.13. WIRING HARNESS	2.13.1. Electrical components of SBD50-Solar with solar charge controller, PWM DC motor speed controller and toggle switch. One (1) assembly	
2.14. EXTENSION CORD	2.14.1. Extension wire for SBD50-Electric. Ten (10) meter	
2.15. AGM BATTERY (OPTIONAL)	2.15.1. Used to store energy to run the ventilator of SBD50-Solar 70 Ampere-hour One (1) unit	
2.16. RODENT GUARD	2.16.1. For platform post to prevent rodent access when storing the empty SBD. Four (4) pieces per pack	
2.17. INSTRUCTION MANUAL	2.17.1. Installation instructions. 2.17.2. Maintenance instructions. 2.17.3. Frequently asked questions and answers. 2.17.4. Warranty clause.	



### 3. COMPONENTS



### 4. SPECIFICATIONS

PARAMETERS		SBD50	
		SOLAR	ELECTRIC
Top Cover		UV-LDPE, Transparent	
Drying Floor		Reinforced PVC, black	
Zipper		Heavy duty zipper	
Rake Mixer		Plastic rake with wooden handle, 2.2m length	
Tube/Roller Mixer**		G.I. Pipe, 2" Ø w/ 2 pcs. Offset box wrench, 17 x19mm	
Frames	Ventilator frame	Aluminum bars	
	Exhaust Support Frame	Aluminum bars	
	Solar panel frame	Aluminum profiles	N/A
Ventilator		12V DC Ventilator, 2 units	220V AC Ventilator, 2units
Solar Panel		100W, 2 units	N/A
Wiring Harness		Auto wire, SCC, PWM, Switch,	Extension Wire, 10m
Connectors/ Terminals		Alligator Clip	N/A
Battery**		AGM (Absorbed Glass Mat) Battery	N/A
Transformer*		N/A	Step up transformer
Dimension, m (ft) (L x W)		26.0x2.0 (85.3x6.56)	
Drying Area, m <sup>2</sup> (ft <sup>2</sup> )		50.0 (538.2)	
Capacity (based on Paddy), kg (lbs)		1,000 (2,204.62)	

\* Included for the countries with 110V electric energy supply

\*\* Optional purchase

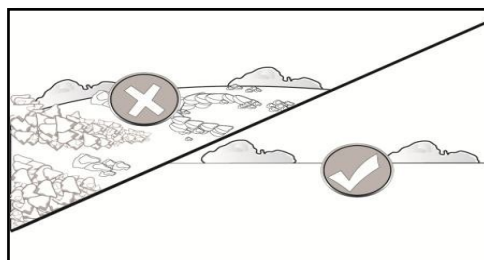


## 5. ASSEMBLY AND OPERATING PROCEDURES

### 5.1. SITE SELECTION

#### 5.1.1. In selecting the site, look for:

- A level ground away from standing or running water.
- Open area for maximum absorption of solar radiation.



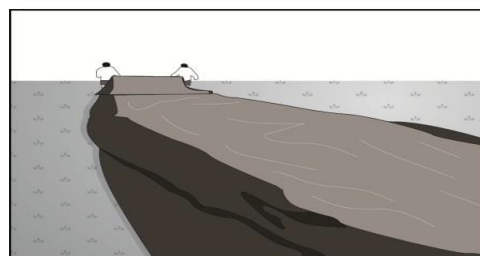
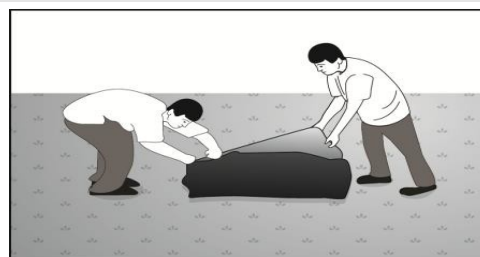
#### 5.1.2. Preparing the selected site (about 4m x 30m) by:

- Clear away all sharp and/or pointed objects (stones, broken glass, nail, etc.) which might puncture the SBD50 drying floor. In addition, refrain from smoking while working because hot ashes may damage the SBD50 materials.
- Make sure there is sufficient space around the SBD50 for pulling the "Tube Mixer" on both sides of the dryer.
- The positioning of the SBD50 and solar panel should be on a location where maximum exposure to solar radiation can be obtained.


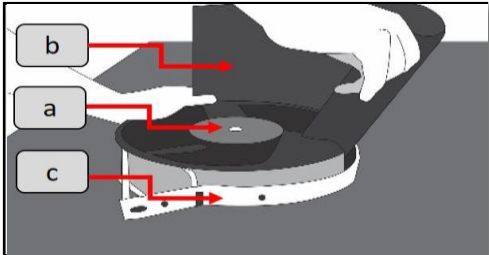
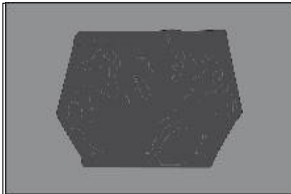
### 5.2. INSTALLATION

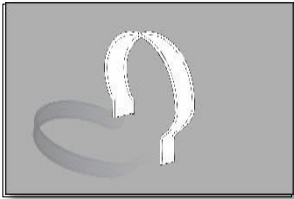
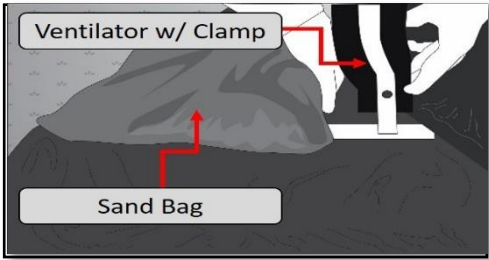
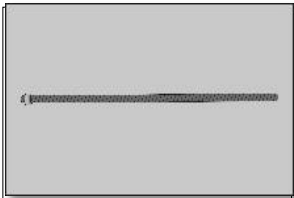
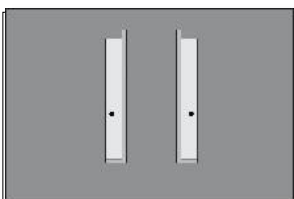
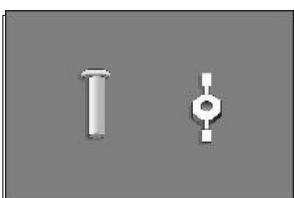
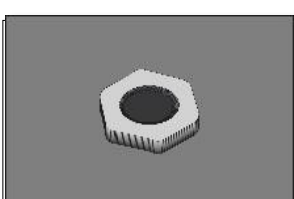
#### 5.2.1. Set-up/installation:

- Unfold the SBD50. Take note of the folding pattern while it is being unfolded. This unfolding sequence should be followed in reverse when preparing for proper storage.
- Pull the other end to get rid of the folds before laying to the ground. Make sure that the drying floor is properly stretched at two meters wide (for the drying area) along the full length of the SBD50. This will ensure that the drying floor will stay flat when using the "Tube mixer".

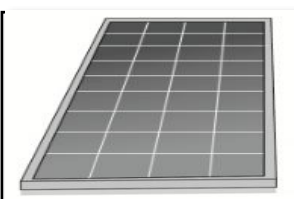
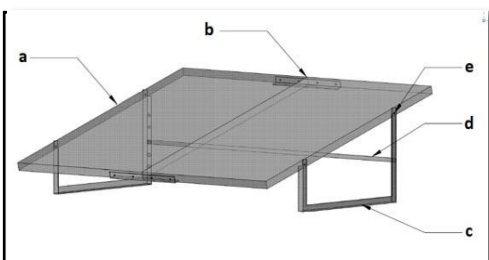
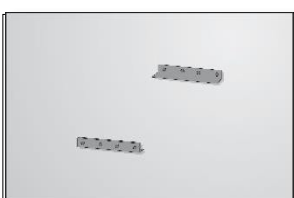


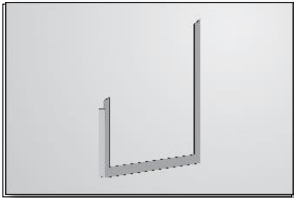

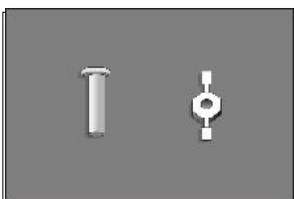
#### 5.2.2. Ventilator and supporting structures:

COMPONENT	IMAGE	SEQUENCE OF ASSEMBLY
a. Ventilator, Two (2) units		 <ol style="list-style-type: none"> <li>Loosen the horizontal brace (d) of the frame.</li> <li>Insert the ventilator cover (b) at the upper portion of the ventilator (a).</li> </ol>
b. Ventilator cover, Two (2) pieces		

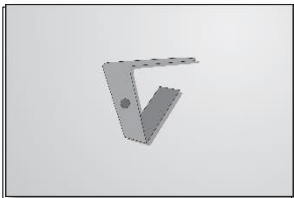
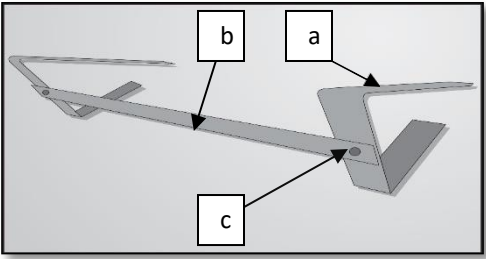
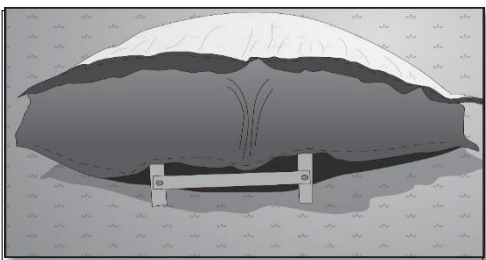
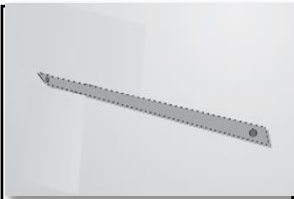
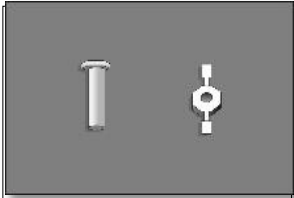
c. Ventilator support clamp, Two (2) pieces		<p>3) Assemble the ventilator support legs (e) using bolts and winged nuts (f) using the screw driver provided.</p>  <p>4) Position the ventilator support legs under the sand bags (fill in the provided sand bag first and fold the other part under it). Sand bag is located along the heating area extension of the drying floor.</p> <p>5) Connect the ventilator to the SBD50 body. Make sure that the direction of airflow is correct (see the arrow printed on the ventilator).</p>
d. Horizontal brace, Two (2) pieces		
e. Ventilator support legs, Four (4) pieces		
f. Bolts and winged nuts, Four (4) sets		
g. Hex nuts, Four (4) pieces		

#### 5.2.3. SBD Solar panel and support assembly:

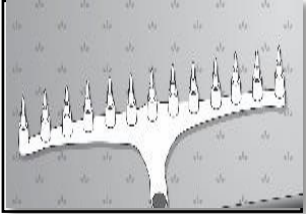

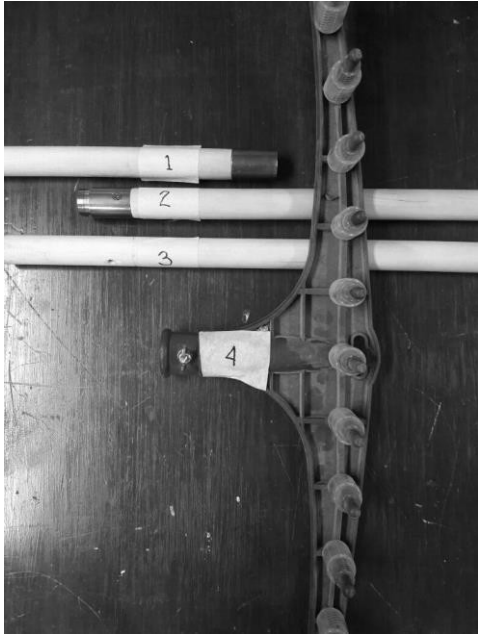
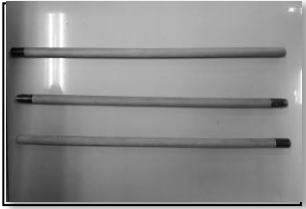

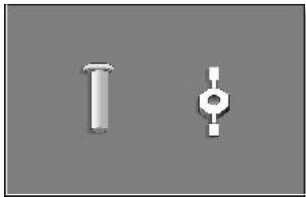
COMPONENT	IMAGE	SEQUENCE OF ASSEMBLY
a. Solar panel, Two (2) units		 <p>1) Assemble the brackets at the top and bottom side attaching the two (2) solar panels.</p>
b. Bracket, Two (2) pieces		

c. Legs, Two (2) pieces		<p>2) Connect the legs on both sides and fix the horizontal brace supporting the two (2) legs.</p> <p>3) Make sure that the longer legs are located on the solar panel circuitry. Use bolts and winged nuts as fastener and the provided screw driver to tighten.</p>
d. Horizontal brace, One (1) piece		
e. Bolts and winged nuts, Sixteen (16) pairs		


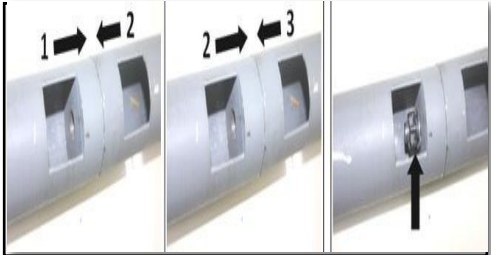



#### 5.2.4. Exhaust support assembly:

COMPONENT	IMAGE	SEQUENCE OF ASSEMBLY
a. Support legs, Two (2) pieces		 <p>1) Assemble the exhaust support frame using bolts and winged nuts.</p>  <p>2) Connect to exhaust port of SBD50 with the pockets provided.</p>
b. Horizontal brace, One (1) piece		
c. Bolts and winged nuts, Two (2) sets		

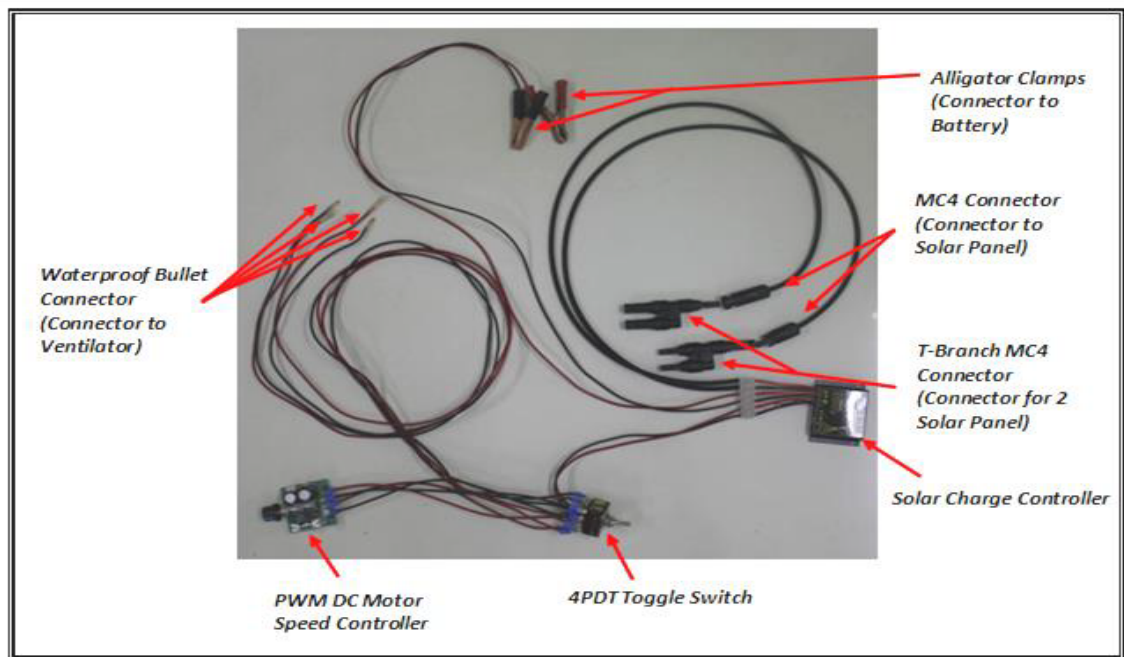
#### 5.2.5. Rake mixer assembly:

COMPONENT	IMAGE	SEQUENCE OF ASSEMBLY
a. Rake head, One (1) piece		  
b. Rake handle, Three (3) pieces		
c. Iron connector		
d. Bolt and hex nut, One (1) set		

#### 5.2.6. Tube mixer assembly:

COMPONENT	IMAGE	SEQUENCE OF ASSEMBLY
a. Disassembled tube mixer, One (1) unit		 <p>1) Connect the three (3) parts of the tube mixer and insert the bolts and hex nut including the lock washer.</p>  <p>2) Tighten the bolts and hex nut using the box wrench.</p>
b. Internal coupler, Two (2) pieces		
c. Box wrench, Two (2) pieces		

### 5.3. WIRING CONNECTION AND ELECTRICAL SAFETY FOR SBD50-SOLAR



#### 5.3.1. Battery Setup

Battery setup, such as charging, safety, etc., is needed before proceeding to wiring installation. The required battery will be a AGM Battery type (12V, 70 Ampere-hour)

##### 5.3.1.1. Battery Safety

- Keep batteries in a place where children cannot reach.
- Red color stands for positive, black for negative. Please connect the pole of the batteries correctly.
- Do not attempt to disassemble or modify by yourself, otherwise the sulfuric acid and lead inside the battery will cause damage to the human body and the environment.
- Avoid the batteries from being continual undercharging and overcharging. Continual undercharging and overcharging will reduce the battery capacity and shorten the battery life span.
- Do not short circuit the positive and negative terminal, otherwise it will easily cause electric shock, fire or breakdown.
- Please always disconnect the main power supply upon installation.
- Please do not use the battery as AC power. Converter like UPS is essential for AC purpose.
- Do not charge the battery in a sealed container or in upside down position. It is recommended to charge the battery in a well-ventilated place.
- Do not charge the battery near a heater, or place where heat accumulation may occur. Do not charge the battery in direct sunlight.
- Do not dispose the battery in water, fire, and don not heat the batteries.
- Do not put your face near the top of the batteries. Wear gloves, eye protection when you measure or repair the battery.

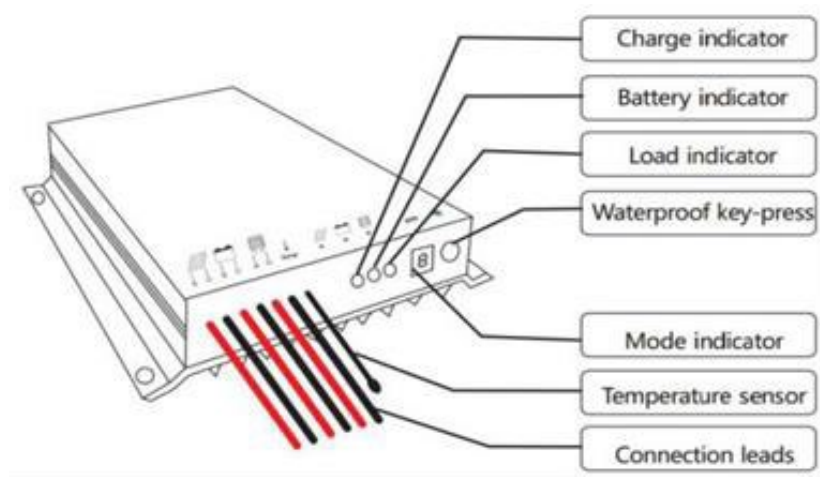
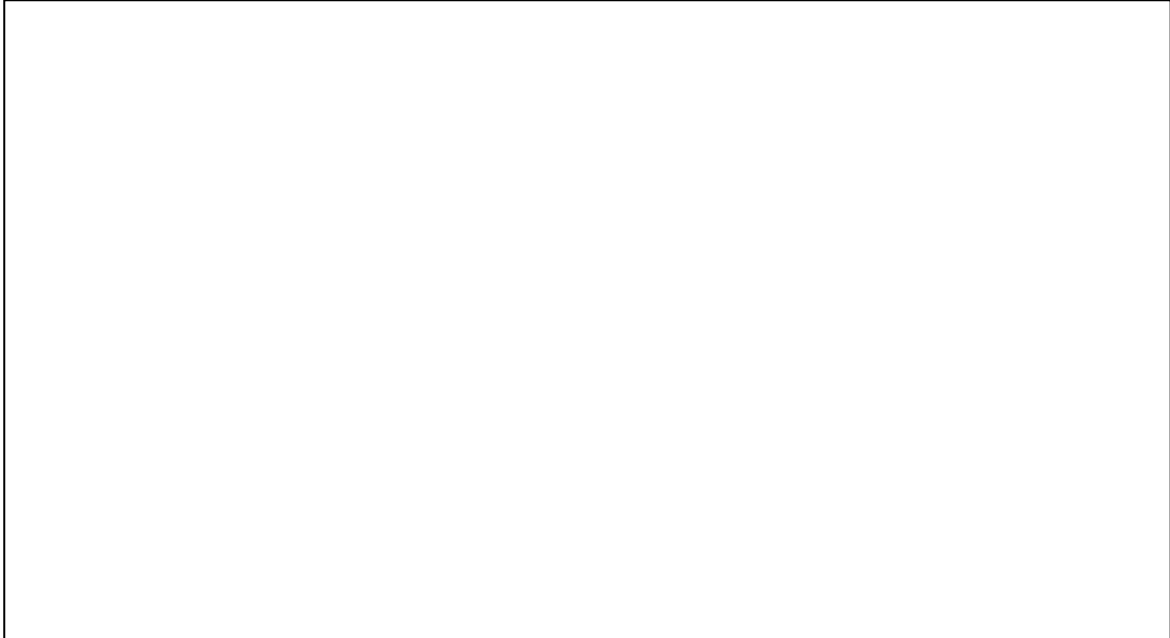
##### 5.3.1.2. Pre-Battery Installation and Charging

- Place the battery in a level surface.  
(WARNING: Keep battery away from spark and flame)

Note:

- If terminal voltage is higher or equal to 12.40V, may proceed to installation.
- If terminal voltage is lower than 12.40V, boostcharge battery before installation.

### 5.3.2. Solar Wiring Schematic Diagram (for SBD50-Solar)



**Solar Charge Controller**

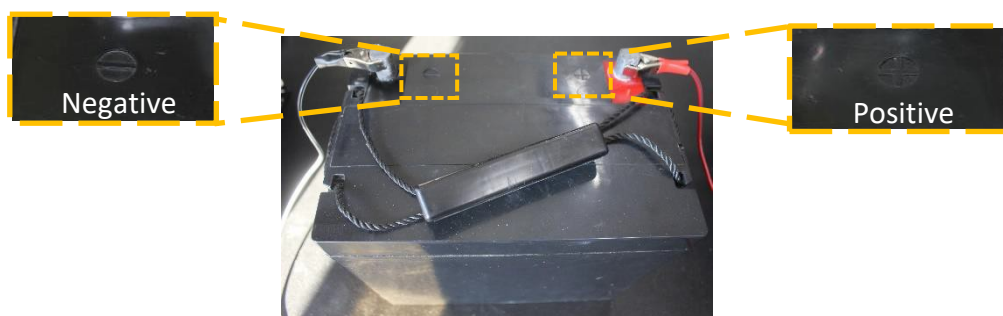
### 5.3.3. Battery Connection

**WARNING: \*DO NOT REMOVE SOLAR PANEL COVER UNTIL ALL STEPS AND/OR CONNECTIONS ARE EXECUTED**


Note:

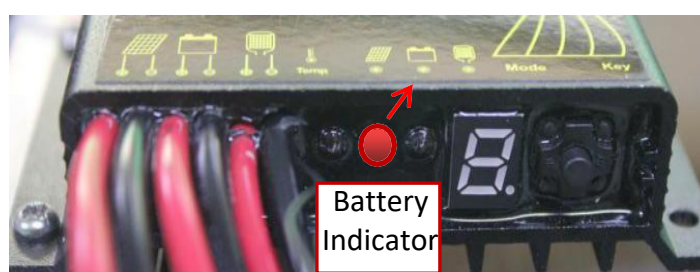
- In case of absence of cover, flatten the solar panel carton box and cover the front of the solar panel.

- a. When installing the Wiring Harness, connect first to the battery. Connect the red alligator clip to the positive “+” battery terminal, and the black alligator clip to the negative “-” battery terminal. Refer to image below.



- b. The controller starts operation after automatically recognizing the battery voltage. For a 12V system, the mode indicator displays Zero dot [0.] initially and then displays seven dot [7.]. The battery indicator also lights up; otherwise, check whether the connection is right.

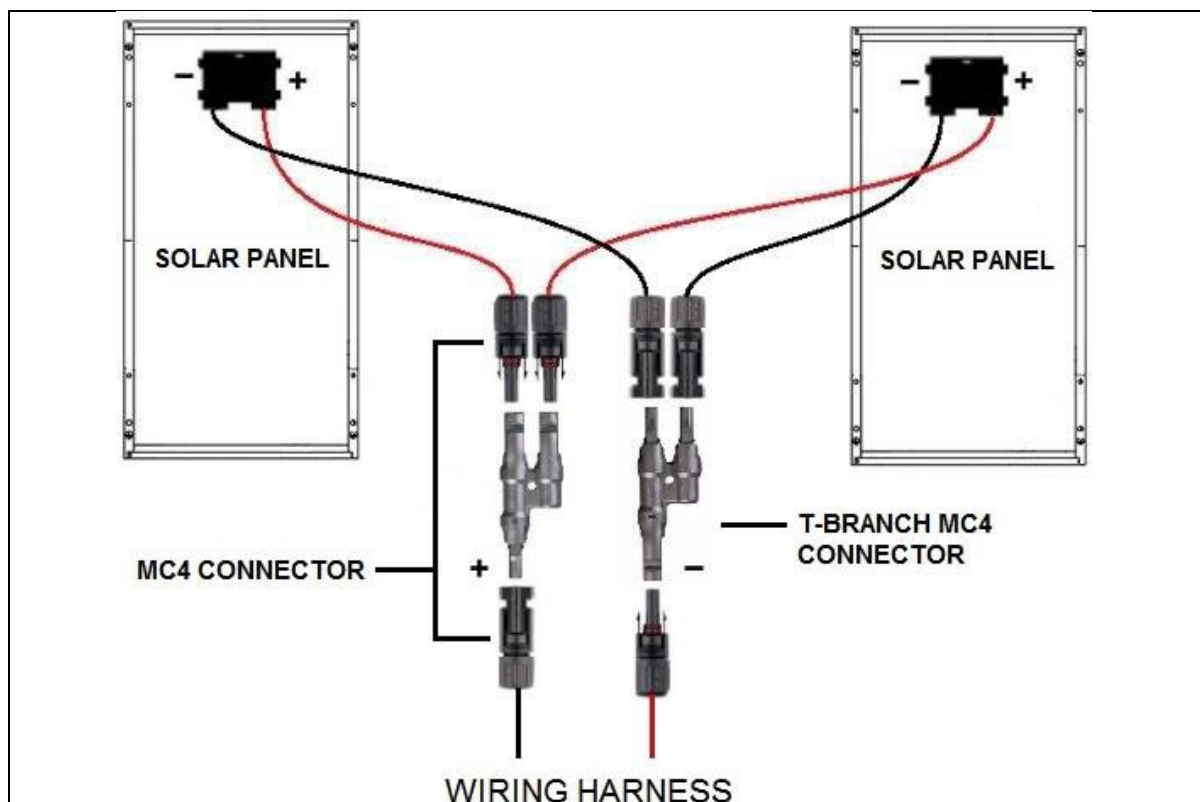
LED lamp	Indications	Status	Functions	Action
	Battery	Steady on	Normal battery function	Proceed to 5.3.4
		Steady off	Battery not connected	Refer to Troubleshooting Case1
		Slow flashing	Battery under voltage	Refer to Troubleshooting Case2
		Quick flashing	Battery over discharged	Refer to Troubleshooting Case3




#### 5.3.4. Solar Panel Connection

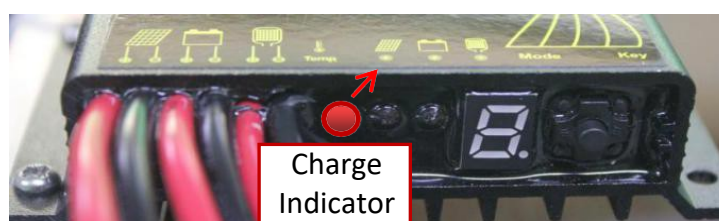
- a. Connect the T-branch MC4 connectors of the wiring harness to the MC4 connectors on the solar panels. Positive “+” and negative “-” connections are not interchangeable.





- b. Due to the solar panels being covered, solar panel/charge indicator shall not light up. When all connections are done, the cover shall be removed and if sunlight is present, the solar panel/charge indicator lights up; otherwise, check whether the connection is correct.

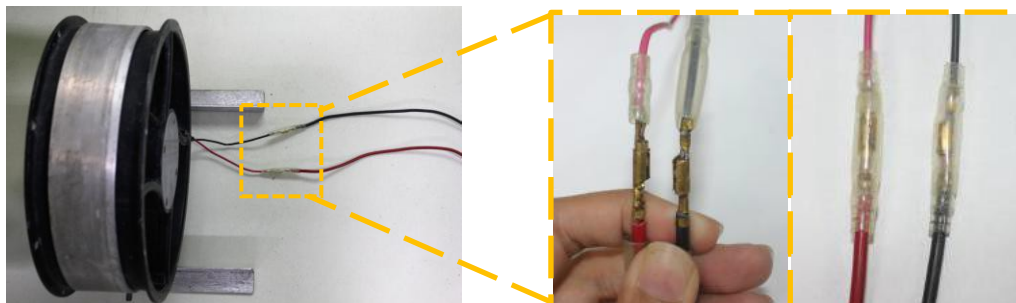
LED lamp	Indications	Status	Functions	Action
	Charging	Steady on	Solar panel with voltage	Wait for slow flashing and Proceed to 5.3.5
		Steady off	Solar panel with no voltage	Refer to Troubleshooting Case 4
		Slow flashing	Charging in process	Proceed to 5.3.5
		Quick flashing	System over voltage	Refer to Troubleshooting Case 5




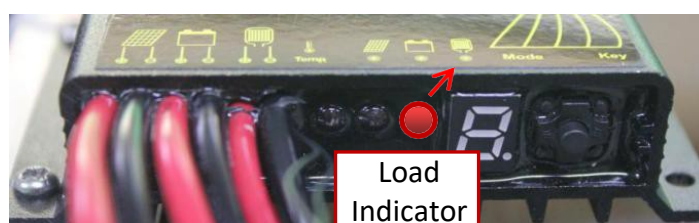
### 5.3.5. Ventilator Connection

- a. Check wires with snap in/ bullet connectors. Connect the longer red wire and longer black wire to 1 ventilator and shorter red wire and shorter black wire to other ventilator.  
Note: Shorter wires control the speed of the ventilator.

- b. Connect the snap in/ bullet connectors of the wiring harness to the snap in/ bullet connector of the ventilator. Positive "+" / red together with negative "-" / black connections are not interchangeable.
- c. Load indicator automatically lights up. Turn on the ventilator from the toggle switch. Upwards for daytime operations and downwards for night-time operations. (Turn off the ventilator before loading of commodities).



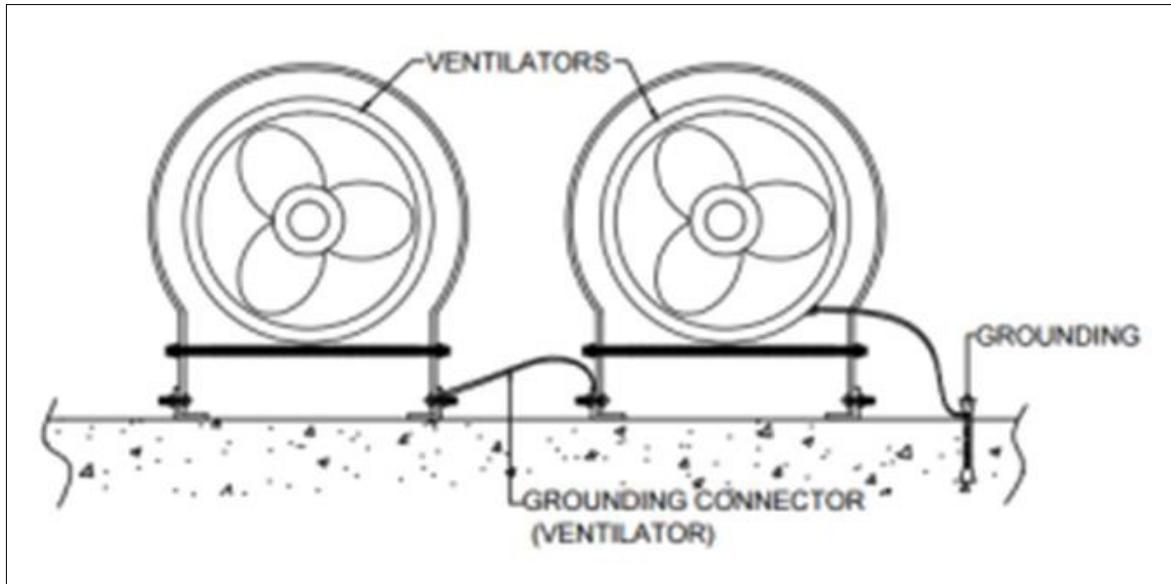
LED lamp	Indications	Status	Functions	Action
	Load	Steady on	Load turned on	If ventilator is running, wiring system is working accordingly. If ventilator is not running Refer to Troubleshooting Case 6
		Steady off	Load turned off	Refer to Troubleshooting Case 7
		Slow flashing	Overload protection	Refer to Troubleshooting Case 8
		Quick flashing	Short-circuit protection	Refer to Troubleshooting Case 9



#### 5.3.6. Grounding Connection

- a. Connect the grounding connector (green/ yellow green wire) to the two ventilator frames.

- b. Connect the grounding wire (green/ yellow green) with ring terminal to the ventilator frame and fix the other end with peg to the ground.
- c. If the area is cemented, lay the peg on the cement and put a heavy object over it, like stone, to have SBD50 grounded.



**GROUNDING CONNECTION DIAGRAM**

#### 5.4. WIRING CONNECTION AND ELECTRICAL SAFETY FOR SBD50-ELECTRIC

##### 5.4.1. Ventilator Connection

Every AC ventilator has its own plug. To run the ventilator, just connect them to a 220V electrical outlet. If the outlet is rated 110V, use the 'step-up transformer' to convert 110V to 220V. A 10-meter extension cord is provided with the SBD50-Electric. Use a longer extension cord if needed. Be careful to avoid possible grounding.

##### 5.4.2. Grounding Connection

Make sure to connect the grounding wires (green/ yellow green) from the ventilator to the ground by pushing the peg into the soil. If the area is cemented, lay the peg on the cement and put a heavy object over it, like stone, to have SBD50 grounded.

#### 5.5. LOADING

##### 5.5.1. Unzip and open one side of the dryer before loading the agricultural commodity.

NOTE:

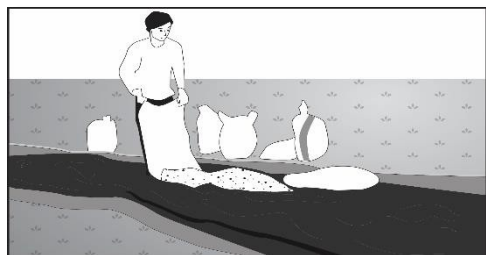
- Loading requires at least two persons.



##### 5.5.2. Place the bagged commodity onto the drying floor and spread evenly on the designated drying area (2m wide).

NOTES:

- The SBD is not designed for drying of "dripping wet" commodities. In those cases, commodity needs to be sundried and final drying (<30% MC) can be (dried) performed in the SBD.

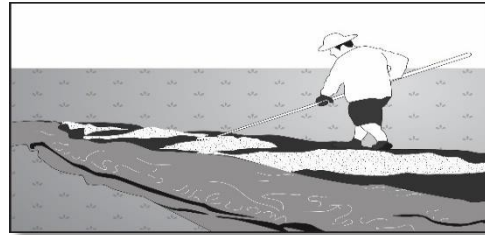


- Do not load the commodity to the pre-heating area within 1.5m from the ventilator.
- Leave space of about 30cm on both sides of the drying floor that will serve as the side wall of the SBD50.

5.5.3. Use the rake mixer to spread the commodity evenly on the drying floor.

NOTE:

- Make sure the tool for spreading the commodity does not have sharp edges which may damage the drying floor.

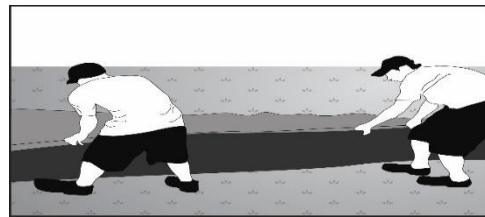


## 5.6. CLOSING

5.6.1. After spreading the commodity evenly close the drying area by completely zipping the heavy-duty zipper around to connect the top cover and the drying floor.

NOTE:

- Opening is done in the opposite manner.



## 5.7. FIXING WALL WITH SUPPORT LOOPS

5.7.1. There are six (6) support loops which are located at the SBD50 wall:

- Near the heating area
- At halfway length of the drying floor
- Near the exhaust port).

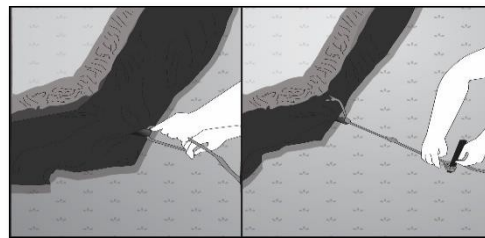
NOTE:

- The use of the middle wall support loop can be optional especially if the "Tube mixer" will be used.

5.7.2. Support the SBD50 by using a rope to tie the loops and peg it to the ground.

5.7.3. This will prevent the SBD50 from being blown by sudden strong winds.

5.7.4. On concrete pavement, it can be tied to a sandbag or any heavy stone or other heavy objects.



## 5.8. VENTILATOR MANAGEMENT (SBD50-SOLAR AND SBD50-ELECTRIC)

5.8.1. DAYTIME OPERATIONS (Ventilator running at normal speed)- switch the toggle switch upwards On.



5.8.2. NIGHTTIME OPERATIONS (Ventilator running at controlled speed using PWM)- switch the toggle switch downwards On.



- 5.8.3. If the ventilator shuts down, press the button on the Solar Charge Controller. The ventilator will run automatically in about 5 seconds if there is enough energy stored in the battery. Otherwise wait till the battery is recharged via the solar panel.

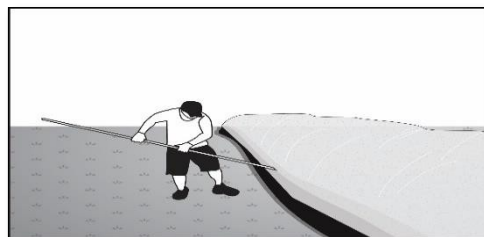
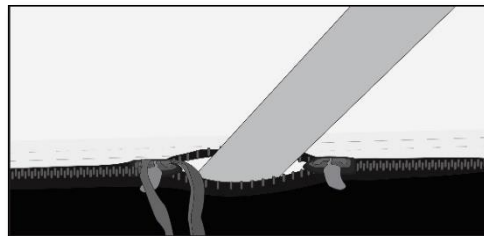
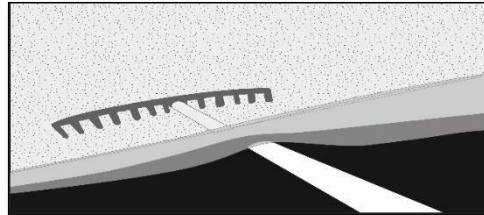
NOTES:

- For SBD50- Electric: connect the 220V ventilators to the grid. If the outlet is 110V use the 'step-up transformer' to convert the 110V to 220V required by the 220V AC ventilator.
- For SBD50-Solar: connect the ventilators to the solar power system. Be careful to avoid possible electric shock. OBSERVE SAFETY FIRST.

## 5.9. MIXING

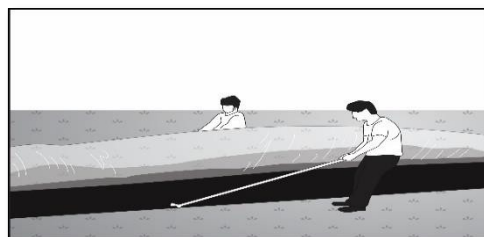
### 5.9.1. Rake mixer:

- a. Insert the rake mixer along the partly opened zipper liner.
- b. Close both zippers up to the rake handle.
- c. Mixing is done like a normal rake mixing in sun drying method. As the rake handle is moved along the zipper line, ensure that you close the zipper slider around the rake handle.



### 5.9.2. Tube Mixer (Optional component):

- a. Designed to provide vertical oscillating motion to mix the commodity inside the bubble.
- b. Two persons are needed to pull the tube mixer under the drying floor. They must pull the tube mixer at the same speed while maintaining the same direction and the same motion.



NOTES:

- Untie the rope at the middle of SBD50 wall before the operation of tube mixer.
- For best mixing results, the tube mixer must be pulled as fast as possible.
- It is recommended to bring the tube mixer to the other end within 12 to 15 seconds.



## 5.10. UNLOADING

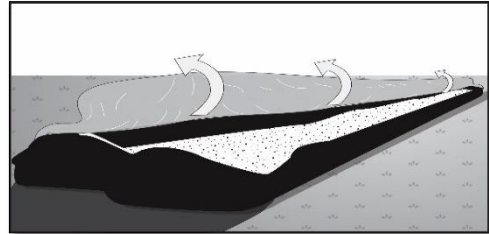
5.10.1. Switch-Off the ventilator after drying the commodity to the desired moisture content.



5.10.2. Open the bubble and bring the top cover to the other side.

NOTE:

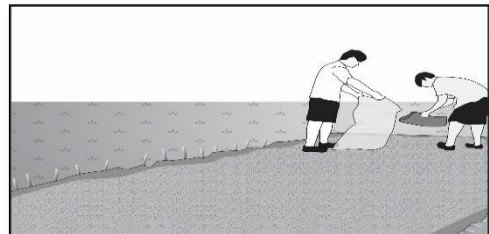
- The top cover can also be completely detached but it is advisable not to completely remove it to protect the commodity in case of sudden rain.



5.10.3. Transfer the commodity to bags or other preferred container for transport floor.

NOTE:

- Make sure the tool for scooping the commodity does not have sharp edges that may damage the drying floor.

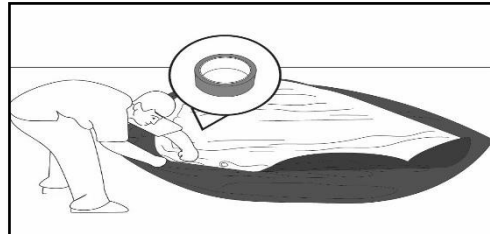


## 6. MAINTENANCE AND CARE

### 6.1. REPAIRING PUNCTURES AND OTHER DAMAGES

6.1.1. Repair procedures (Drying floor):

- a. Use the ducting tape (grey) found in the repair kit to patch the damaged section.
- b. Clean the surface of the damaged area with damp cloth and allow to dry before applying the PVC duct tape.



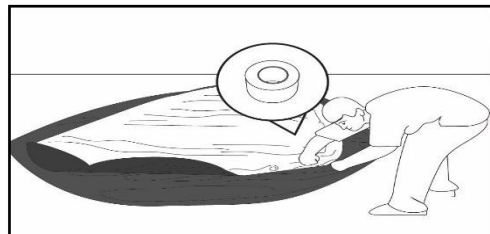
- c. Cut-out a piece large enough to cover the damaged section to be applied at the outside surface of the drying floor preventing from drumming of rake during mixing the commodity.
- d. Manually press the patching tape against the damaged area.

6.1.2. Protective maintenance:

- a. Check the patched ducting tape occasionally and replace or re-patch if necessary.

6.1.3. Repair procedures (Transparent top cover):

- a. Use the UV-Transparent PE tape found in the repair kit to patch the damaged section.
- b. Clean the surface of the damaged section with damp cloth and allow to dry before applying the PE tape.



- c. Cut-out a piece large enough to cover the damaged section and to be applied at the outside surface of the transparent cover preventing rain water.
- d. Manually press the patching tape against the damaged section.

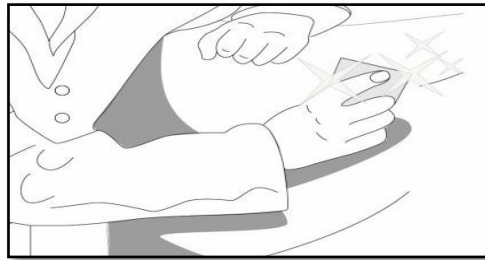
6.1.4. Protective maintenance:

- a. Check the patched PE tape occasionally and replace or re-patch if necessary.

## 6.2. CLEANING THE TOP COVER AND BOTTOM SECTION

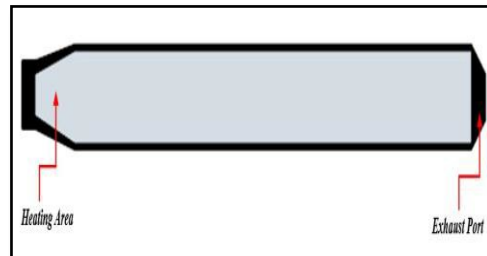
6.2.1. If necessary with soap and water.

6.2.2. Dry under the sun.

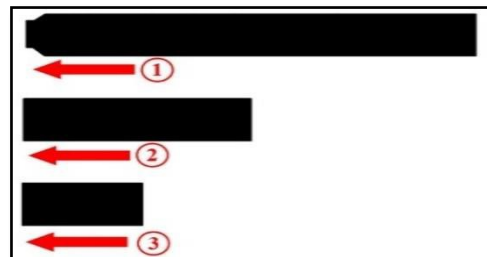


## 6.3. BODY FOLDING INSTRUCTION

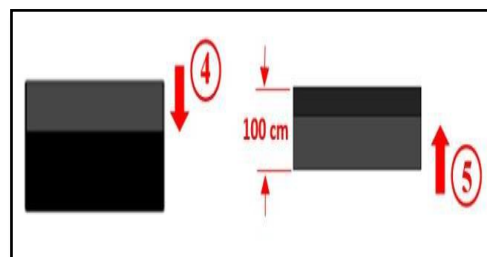
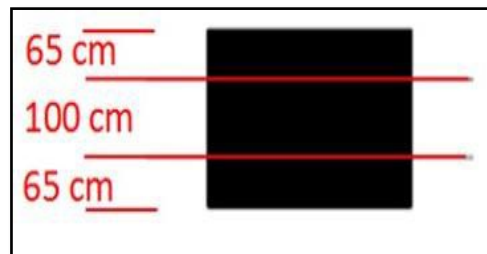
6.3.1. Lay down the SBD50 body on a flat surface and be sure that all the components of the body are assembled (top cover shall be attached to drying floor).



6.3.2. Fold the SBD body into half (3x) by holding and pulling the exhaust port to the heating area.

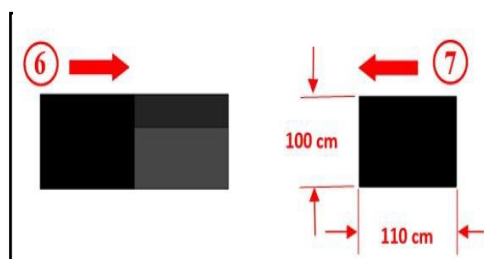
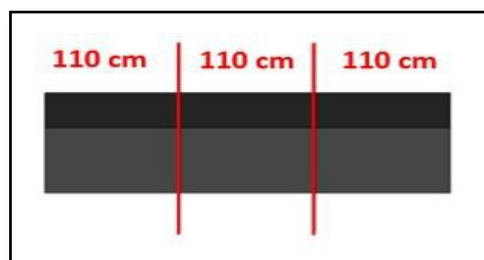


6.3.3. Fold each side with a measurement of 65cm, and make sure that 100cm width in the middle is maintained.

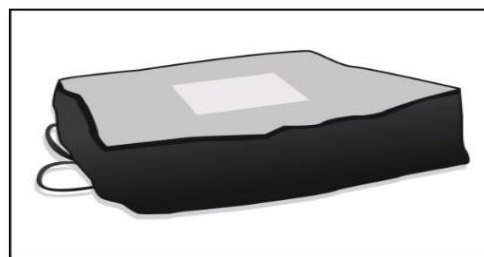




6.3.4. Fold the length into three (3) equal parts. Make sure that the first portion to fold is where the both ends (heating area and exhaust port) are located.



6.3.5. Make sure that the final dimension is 100cm x 110cm to fit into the carrying bag.



#### 6.4. BATTERY CHARGING, MAINTENANCE AND STORAGE

##### 6.4.1. Battery Charging

- Batteries should be charged after every use to ensure they do not sit in a low state of charge condition for extended periods.
- Lead acid batteries do not have a memory affect. (They do not need to be fully discharged prior to charging)
- Add water to cells after charging up to a level of 1/8" below the bottom of the vent well. Do not overfill the battery. Use only distilled water. Do not use tap water.
- Never add acids/electrolyte to cells.
- Check your batteries once a month after installation to determine the proper watering schedule.

##### 6.4.2. Battery Inspection and Cleaning

- Keep batteries clean and dry.
- Check that all vent caps are tight.
- Check that all connections are tight.
- Terminal protector should be applied to terminals to reduce corrosion.
- Use a solution of baking soda and water to clean if there is acid residue on batteries or corrosion on the terminals.

##### 6.4.3. Battery Storage

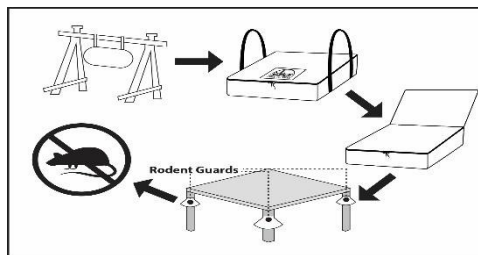
- It is suggested to store the battery in a well-ventilated place. If the battery has high temperature or poor ventilation during storage and delivery, the self-discharge will increase.
- The best storage temperature is 25°C.
- Keep batteries away from fire, flames, heat supply etc.
- Do not store the batteries in a discharge state for a long period of time, recharge the battery after discharge to keep the capacity.

## 6.5. SAFEKEEPING

- 6.5.1. Emptied SBD50 should be stored away from heat or direct sunlight and out of reach of rodents preferably on a shelf, on an elevated pallet or suspended from a beam or girder.

### NOTE:

- Do not place heavy object on top of the stored bag as it may damage or deform it.



## 6.4. RECYCLING

GrainPro Solar Bubble Dryer is made of PVC and LDPE materials.

- 6.4.1. The products can be delivered to the nearest recycling facilities in the area.
- 6.4.2. Plastic #3 – PVC (Vinyl) can be recycled into paneling, flooring, speed bumps, decks or roadway gutters.
- 6.4.3. Plastic #4 – LDPE (Low Density Polyethylene) can be recycled into compost bins, paneling, trash can liners and cans, floor tiles, and shipping envelopes.

## 6.6. PLATFORM INSTALLATION OF RODENT GUARD (RG)

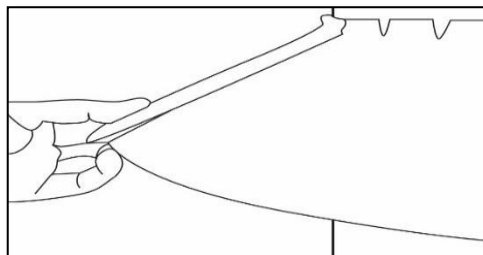
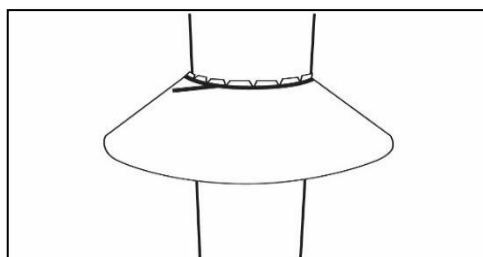
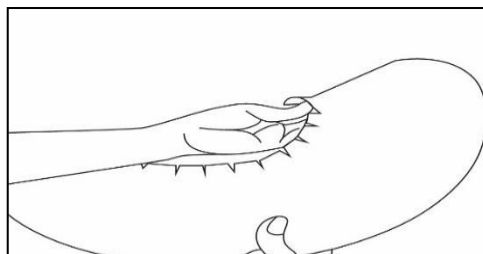
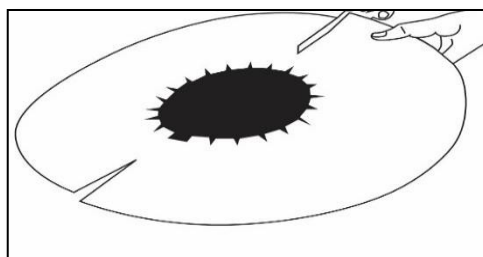
- 6.6.1. For protection against rodent attacks (one set contains 4 pieces):

- One set can be installed on any platform legs with leg perimeter (round or square) of 22 cm (9") to 44 cm (17").
- If the dimension of the platform leg is smaller, the rodent guard can be cut in half to fit. Cut along the lines at the back of the rodent guard.

- 6.6.2. Fold the rodent guard's teeth upwards against the sides of the leg to keep it from slipping.

- 6.6.3. Make sure to overlap the sides at least one inch.

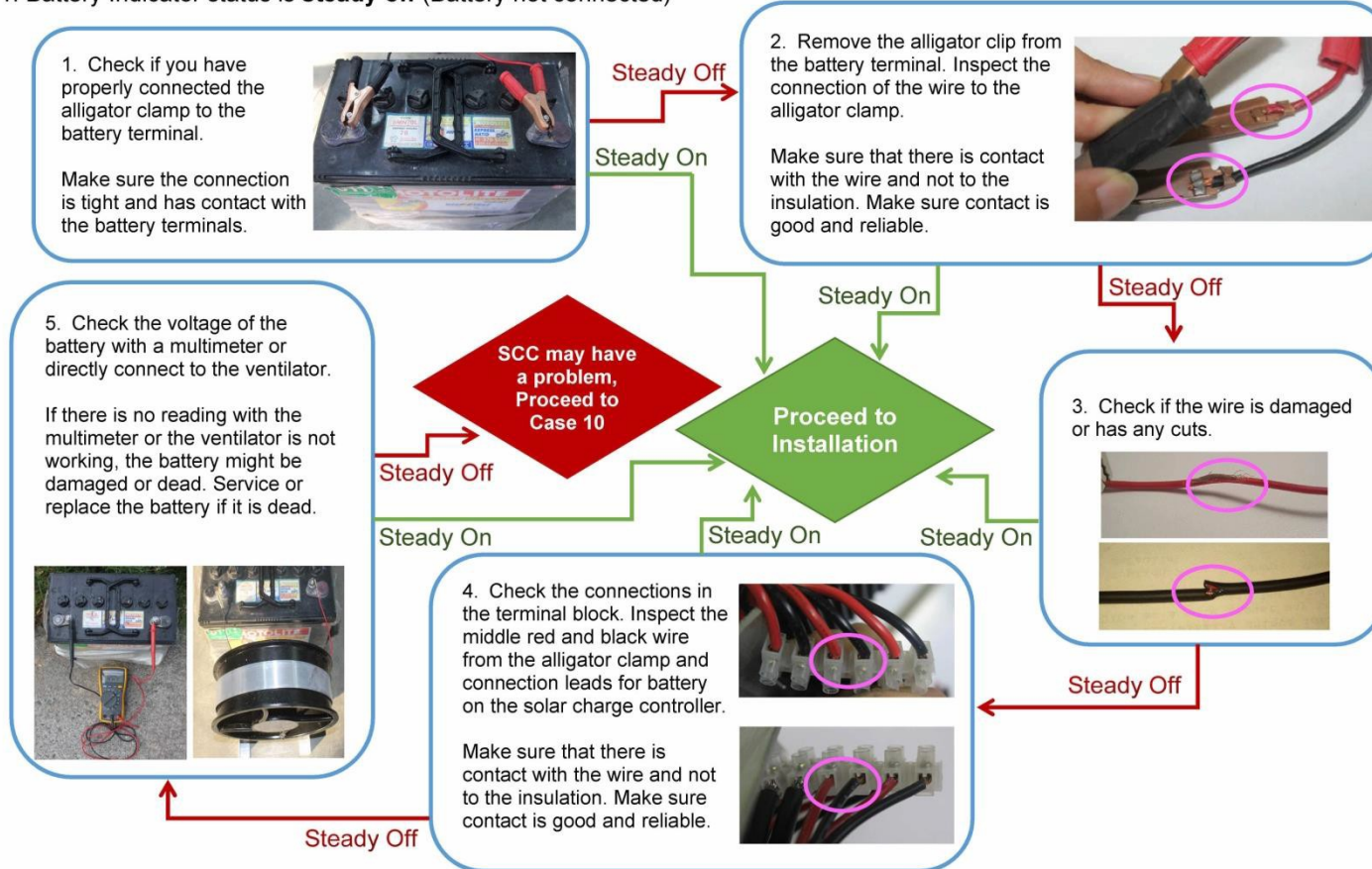
- 6.6.4. Close the overlap together by using a staple, cable wire, or any fastener.



## 7. TROUBLE SHOOTING: SBD-SOLAR WIRING HARNESS

### 7.1. CASE 1: BATTERY INDICATOR STATUS IS "STEADY OFF" (BATTERY NOT CONNECTED)

Case 1: Battery Indicator status is **steady off** (Battery not connected)

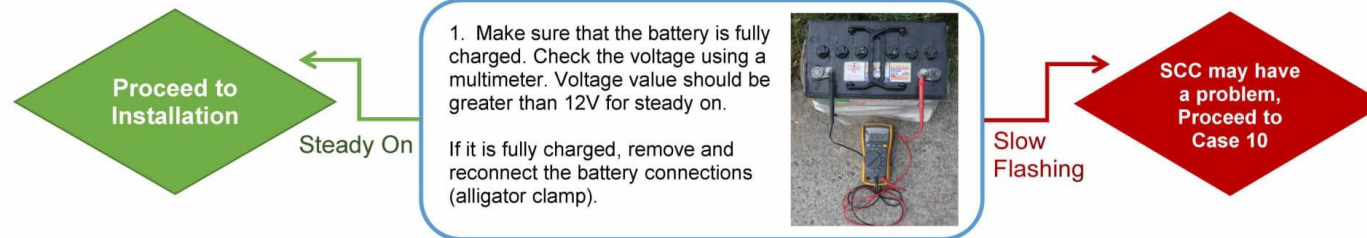


**Note:** **Steady On** - battery indicator is steady on or working normally  
**Steady Off** - battery indicator is still steady off proceed to next

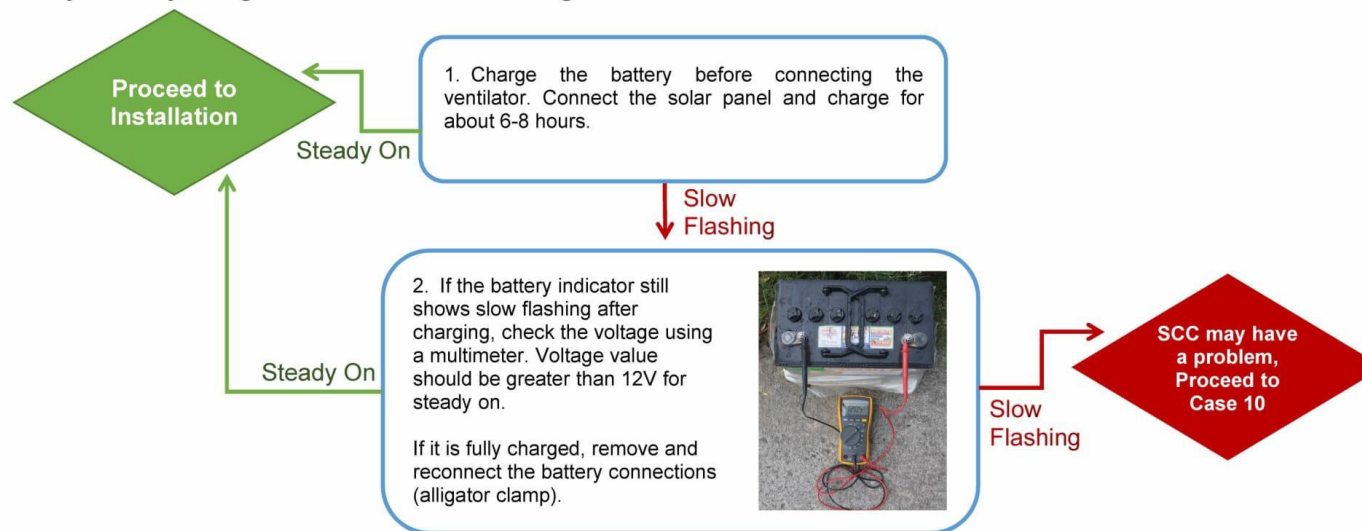
## 7.2. CASE 2: BATTERY INDICATOR STATUS IS "SLOW FLASHING" (BATTERY UNDER VOLTAGE)

Case 2: Battery Indicator status is **slow flashing** (Battery under voltage)

- **Battery fully charged and shows slow flashing**



- **Battery not fully charged and shows slow flashing**

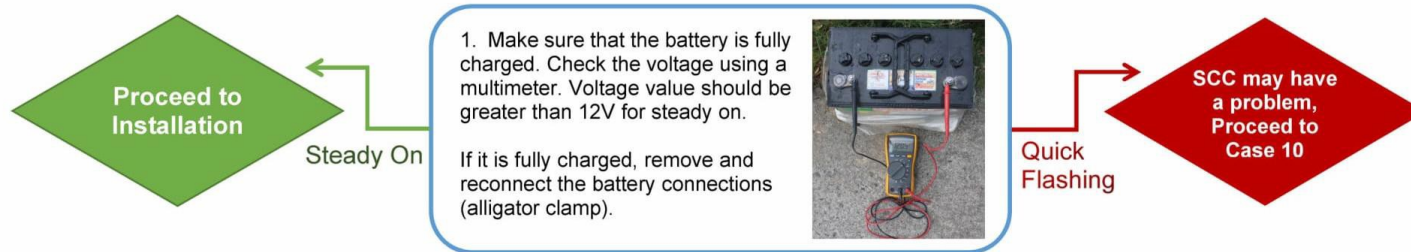


*Note:* Steady On - battery indicator is steady on or working normally  
Slow Flashing - battery indicator is still slow flashing proceed to next

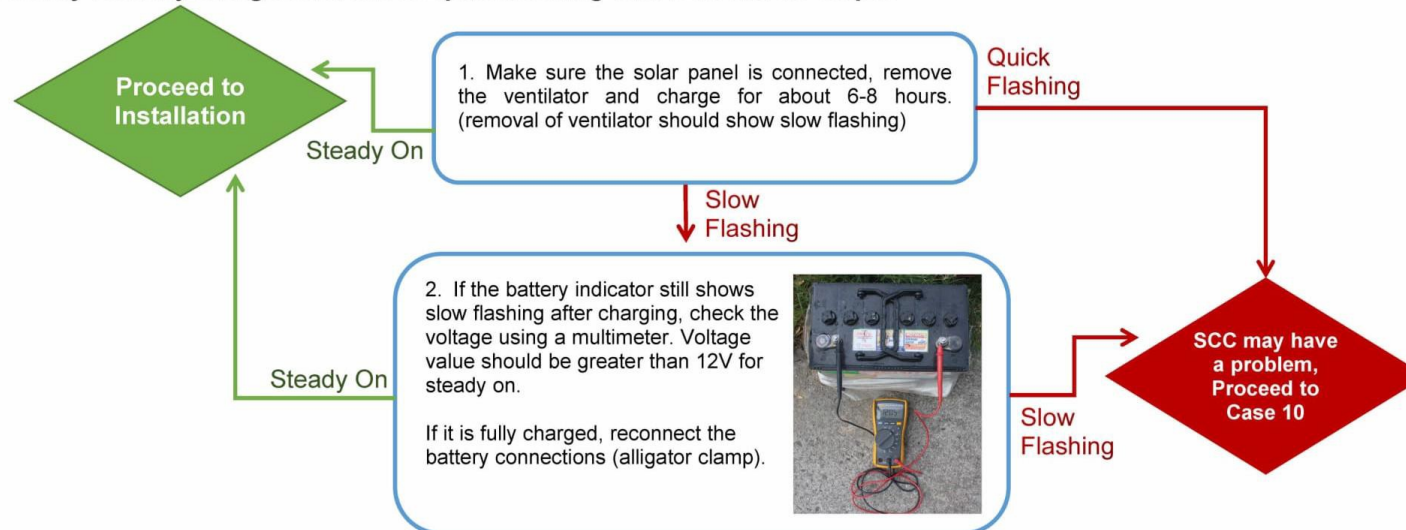
### 7.3. CASE 3: BATTERY INDICATOR STATUS IS “QUICK FLASHING” (BATTERY OVER DISCHARGED)

Case 3: Battery Indicator status is **quick flashing** (Battery over discharged)

- **Battery fully charged and shows quick flashing with load connected (both for ventilator running and not running)**



- **Battery not fully charged and shows quick flashing with load and no output**

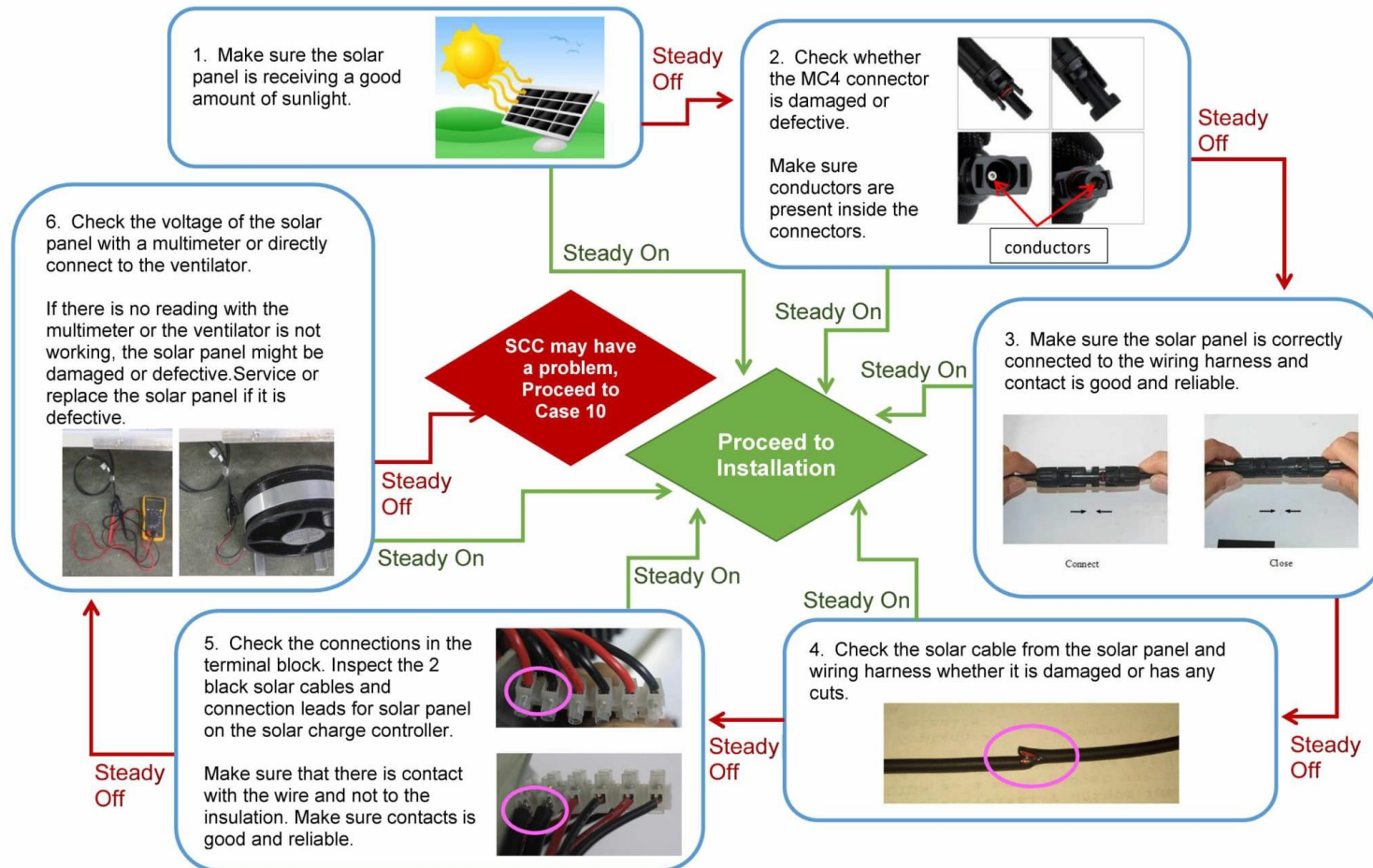


Note: **Steady On** - battery indicator is steady on or working normally  
**Quick Flashing** - battery indicator is still quick flashing proceed to next  
**Slow Flashing** - battery indicator is still slow flashing proceed to next



#### 7.4. CASE 4: SOLAR PANEL/CHARGE INDICATOR IS "STEADY OFF" (SOLAR PANEL NO VOLTAGE)

Case 4: Solar Panel/Charge Indicator status is **steady off** (Solar panel no voltage)



Note: **Steady On** - charge indicator is steady on or working normally  
**Steady Off** - charge indicator is still steady off proceed to next

7.5. CASE 5: SOLAR PANEL/CHARGE INDICATOR IS “QUICK FLASHING” (SYSTEM OVER VOLTAGE)

Case 5: Solar Panel/Charge Indicator is **quick flashing** (System over voltage)



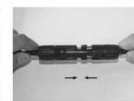
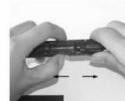
Steady On

1. Check if you have the correct battery required for the system. If you do not know the specification of your battery, measure the voltage value using a multimeter. Rated voltage for battery should be 12V, battery value should range from 12V-14V when measuring newly purchased batteries.



Quick Flashing

2. Remove and reconnect the battery connections (alligator clamp) and then solar panel connections (MC4 connectors).



Quick Flashing

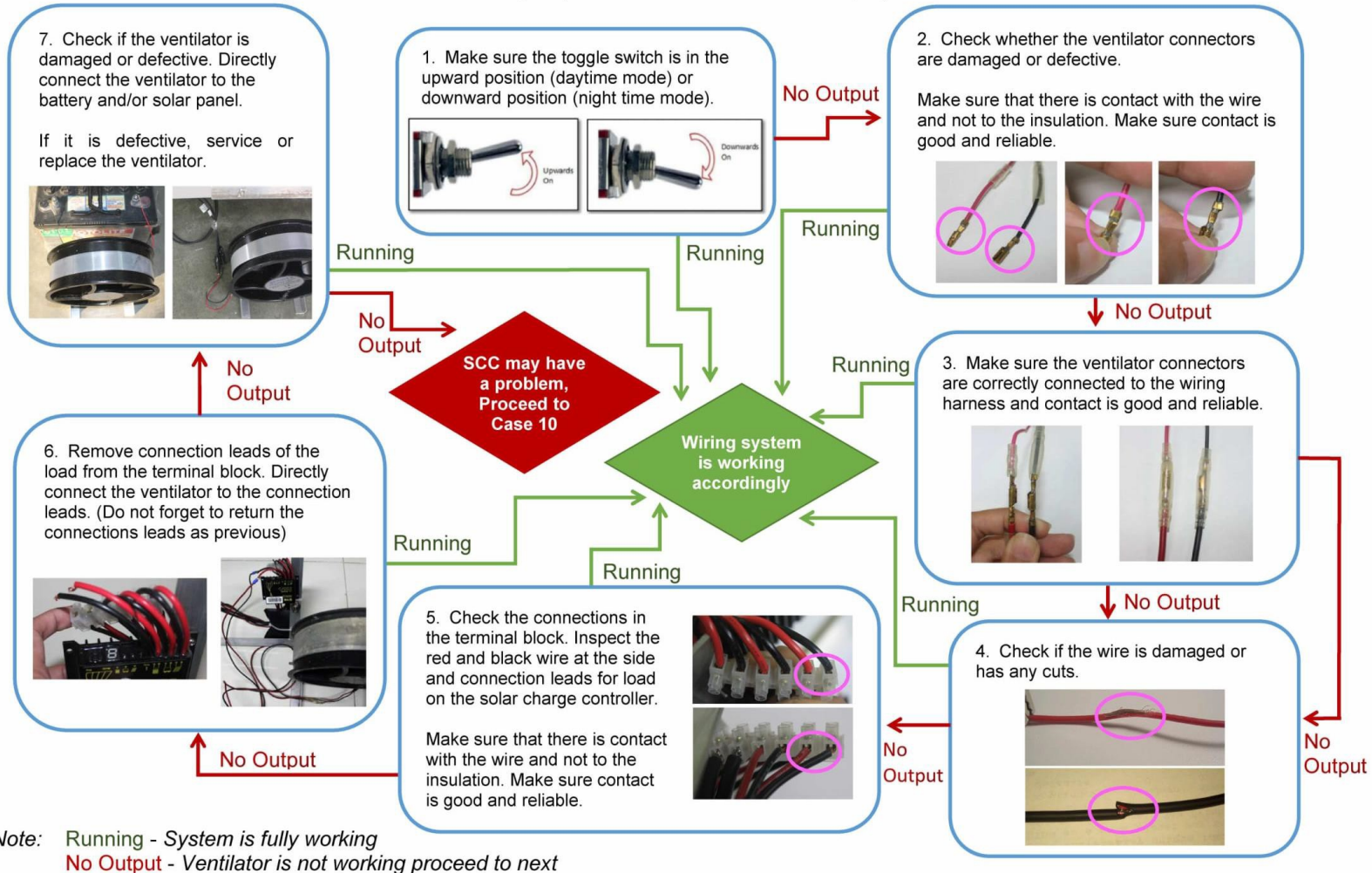
SCC may have a problem, Proceed to Case 10

*Note:* **Steady On** - charge indicator is steady on or working normally  
**Quick Flashing** - charge indicator is still quick flashing proceed to next



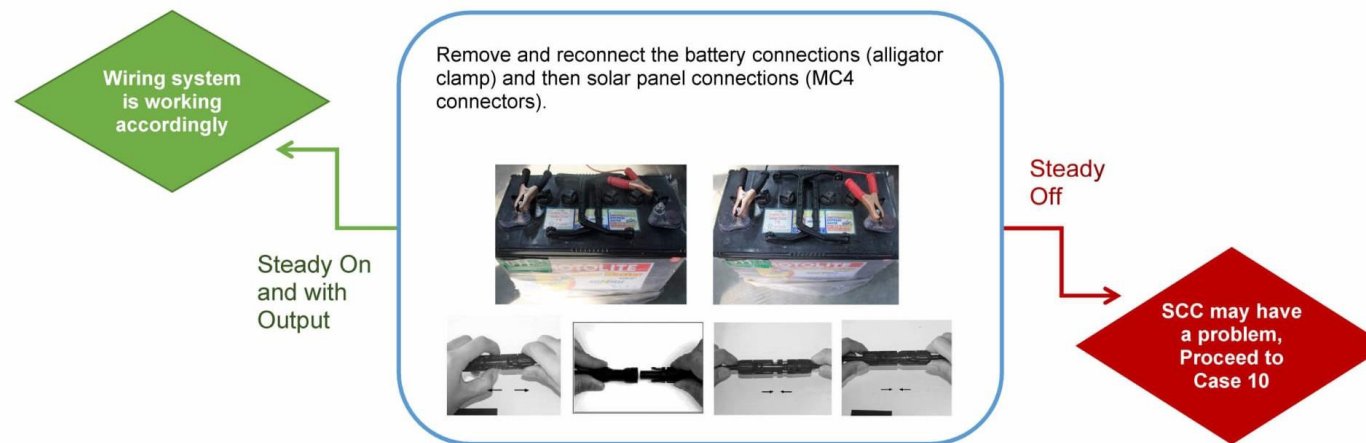
## 7.6. CASE 6: LOAD INDICATOR IS "STEADY ON BUT THERE IS NO OUTPUT" (LOAD TURNED ON BUT WITHOUT OUTPUT)

Case 6: Load Indicator is **steady on but there is no output** (Load turned on but without output)



7.7. CASE 7: LOAD INDICATOR IS "STEADY OFF" (LOAD TURNED OFF)

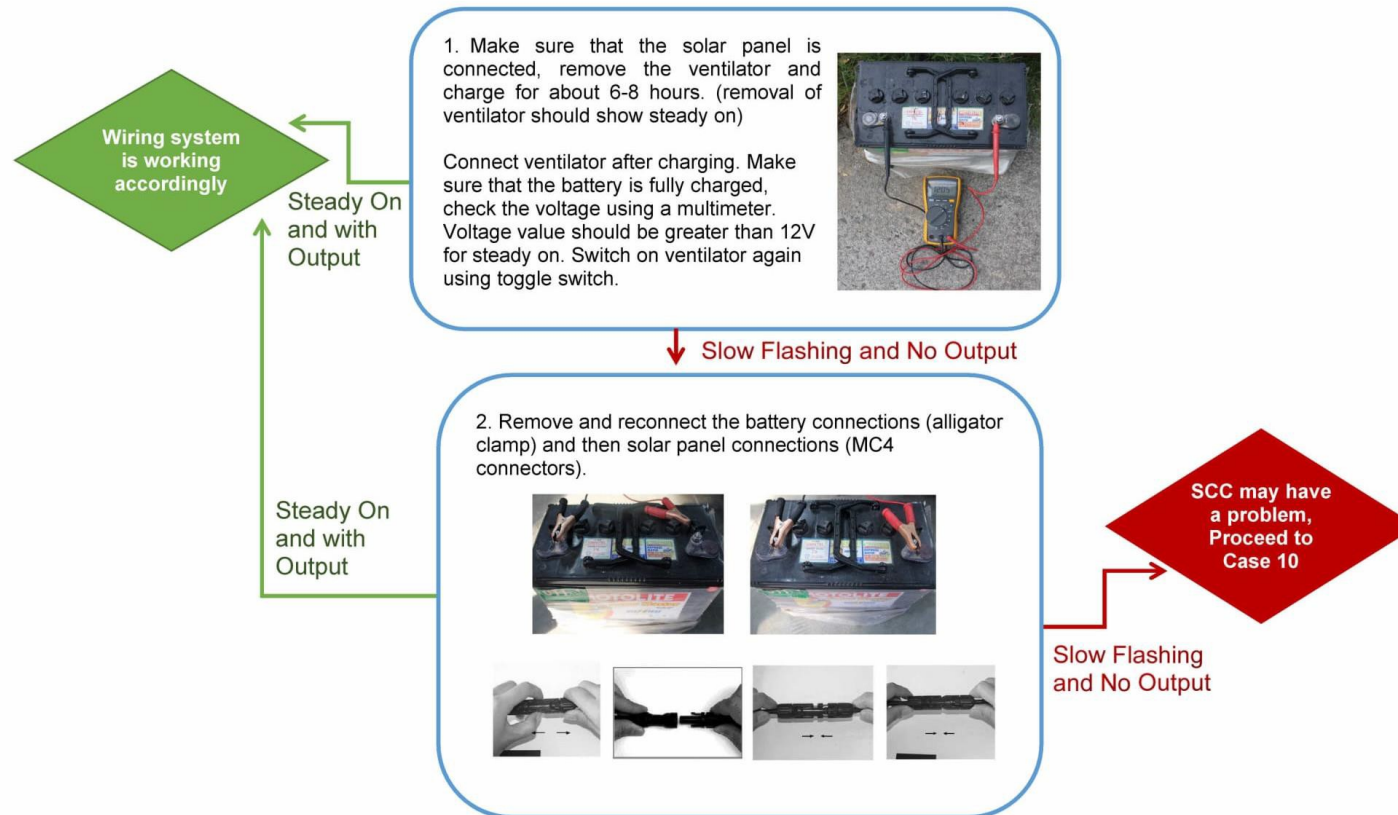
Case 7: Load Indicator is **steady off** (Load turned off)



*Note:* **Steady On and with Output** - load indicator is steady on and ventilator is running or working  
**Steady Off** - load indicator is still steady off proceed to next

7.8. CASE 8: LOAD INDICATOR IS "SLOWLY FLASHING AND THERE IS NO OUTPUT" (OVERLOAD PROTECTION)

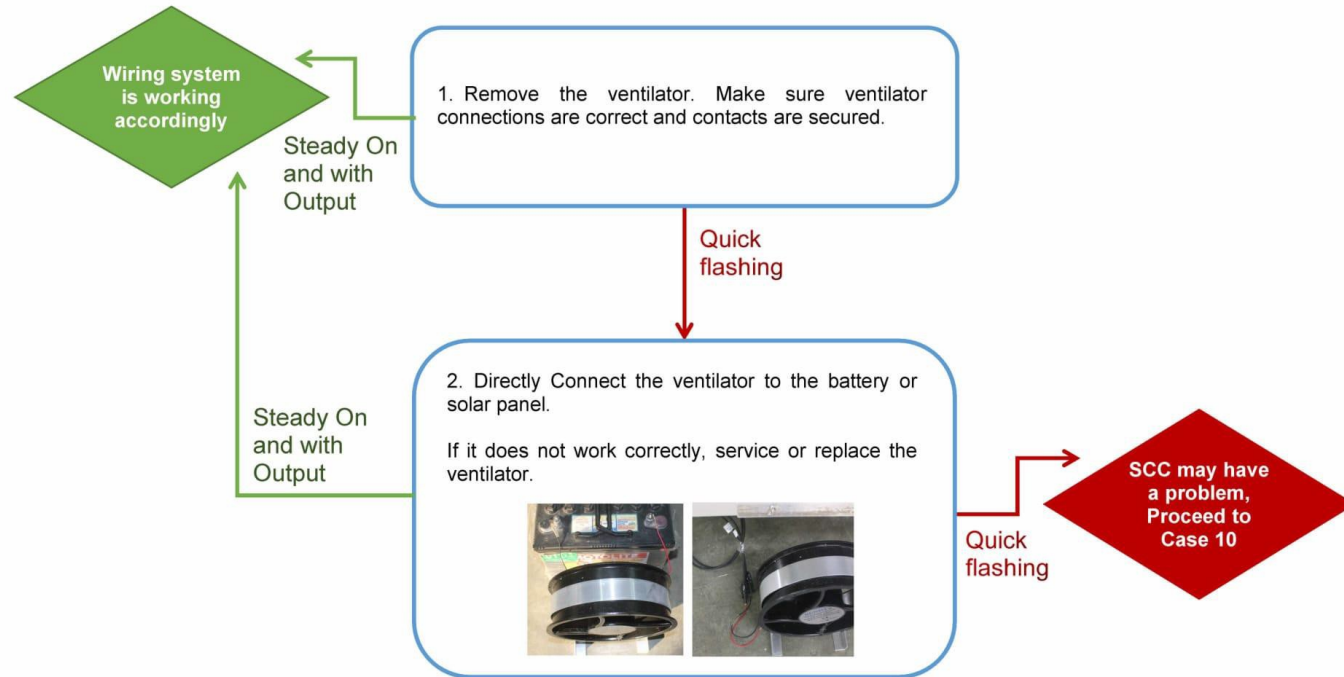
Case 8: Load Indicator is **slow flashing and there is no output** (Overload protection)



*Note:* **Steady On and with Output** - load indicator is steady on and ventilator is running or working  
**Slow Flashing and No Output**- load indicator is still slow flashing and ventilator is not running proceed to next

7.9. CASE 9: LOAD INDICATOR IS "QUICK FLASHING AND THERE IS NO OUTPUT" (SHORT-CIRCUIT PROTECTION)

Case 9: Load Indicator is **quick flashing and there is no output** (Short-circuit protection)



*Note: Steady On and with Output - load indicator is steady on and ventilator is running or working  
Quick Flashing - load indicator is still quick flashing proceed to next*

## 7.10. CASE 10: SOLAR CHARGE CONTROLLER IS NOT WORKING PROPERLY

### Case 10: Solar Charge Controller is **not working properly**

- **Mode Indicator is not showing seven dot [7.]**

Mode Indicator	Mode	Mode Indicator	Mode
0	Purely light-operated	9	Light control + time control (9 hours)
1	Light control + time control (1 hour)	0.	Light control + time control (10 hours)
2	Light control + time control (2 hours)	1.	Light control + time control (11 hours)
3	Light control + time control (3 hours)	2.	Light control + time control (12 hours)
4	Light control + time control (4 hours)	3.	Light control + time control (13 hours)
5	Light control + time control (5 hours)	4.	Light control + time control (14 hours)
6	Light control + time control (6 hours)	5.	Manual mode
7	Light control + time control (7 hours)	6.	Debugging mode
8	Light control + time control (8 hours)	7.	Normal On mode

Mode Indicator	Battery Type	Mode Indicator	Battery Type
1	Sealed lead-acid battery	5	4 strings of ternary-material lithium batteries
2	GEL lead-acid battery	6	7 strings of ternary-material lithium batteries
3	Flooded lead-acid battery	7	4 strings of lithium iron phosphate batteries
4	3 strings of ternary-material lithium batteries	8	8 strings of lithium iron phosphate batteries

#### **Load Working Mode Setting Method**

1. Press the key for no less than 3 seconds, the mode indicator will begin to flash indicating that the system can be adjusted, release the key after.
2. Click the key until you see seven dot [7.] on the mode indicator.
3. Wait until the mode indicator stops flashing or press the key again for no less than 3 seconds to complete the settings.

#### **Battery Type Setting Mode Method**

1. Repeat step 1 and 2 of **Load Working Mode Setting Method** but click the key until five dot [5.].
2. Release the key, and long press the key again. The three light indicator and mode indicator will begin to flash.
3. Click the key until you see two [2] for the appropriate battery type mode.
4. Long press the key. When the light indicators stop flashing, the setting is complete and mode indicator exits to the seven dot [7.] mode.
5. Temporarily cover the key press button with masking tape.

- **Charge, Battery, and/or Load Indicator not working properly**

1. Remove all connections.
2. Go to item **5.3 Wiring Connection and Electrical Safety**, Make sure to follow all the setup and steps accordingly.

*Note: If the key is covered with a "do not remove" sticker, just press the covered key. Avoid pressing the key/covered key in the future. Provided/ suggested battery is flooded lead-acid battery. Battery type can be changed depending on the battery used.*

## 8. FREQUENTLY ASKED QUESTIONS AND ANSWERS

- 8.1. WHAT IS THE SOLAR BUBBLE DRYER OR SBD50?
- The SBD50 is a state-of-the-art solar drying product for agricultural commodities. It is designed to improve the drying process and prevent the growth of aflatoxin because of delayed drying due to intermittent rainfall during the drying process. With the “greenhouse effect”, the SBD50 traps solar radiation and heats up the commodity inside and vaporizes its moisture. The ventilator then pushes the moist air out.
- 8.2. HOW MANY PERSONS ARE NEEDED TO ASSEMBLE AND OPERATE THE SBD50?
- A minimum of two (2) persons are needed to assemble and operate the SBD50.
- 8.3. WHAT COMMODITIES CAN BE DRIED IN IT?
- The SBD50 can be used to dry a wide variety of grains, i.e. rice paddy, maize, wheat, nuts, beans (coffee, cacao, soybean), and others.
- 8.4. WHAT IS THE SBD50 DRYING CAPACITY?
- For paddy and corn, it has an optimum drying capacity of one (1) metric ton or 1,000 kg. For faster drying, a 30 minutes mixing interval is recommended.
- 8.5. WHAT HAPPENS IF I DRY MORE THAN THE RECOMMENDED CAPACITY?
- The drying time will be longer.
- 8.6. HOW QUICKLY CAN THE SBD50 DRY THE COMMODITY?
- Drying time is dependent on the type of commodity, moisture content, air temperature and the relative humidity of the ambient air. On a full sunny day, paddy can be dried in about 8 hours from 22% to 14% moisture but the drying rate can be increased by increasing the mixing frequency. The average drying rate for paddy and maize is about 1% MC per 2 hours under intermittent rains and cloudy weather.
- 8.7. WHAT SETS THE SBD APART FROM OTHER TYPES OF MECHANICAL DRYERS?
- The SBD50-Solar uses purely solar energy. It does not contribute to environmental pollution and climate change. It does not require the construction of a shed, unlike the flatbed dryer, to protect the grains from the elements.
- 8.8. DOES HEAT FROM THE SUN AFFECT THE COMMODITIES BEING DRIED IN THE SBD50?
- Yes. The amount of solar radiation significantly affects the drying rate and the amount of solar energy available for storage in the AGM battery.
- 8.9. WHAT ARE THE CHANCES OF “BAKING” THE COMMODITY BEING DRIED?
- If the ventilators are running and the commodity is frequently mixed at regular interval, and the moisture content is regularly checked then “baking” or overheating the commodity will be prevented.
- 8.10. CAN I RUN THE SBD50 AT NIGHT TIME?
- Yes. The ventilator will run at controlled speed (using PWM) to keep the bubble up.
- 8.11. IS IT SAFE TO SET UP THE SBD50 WHEN IT’S RAINING OUTSIDE?
- No. Setting up the SBD should be done while it’s not raining to avoid water accumulation in the drying floor and soaking the commodity to be dried. When raining, it is recommended to wait before setting up the SBD50.
- 8.12. CAN I RUN THE SBD50 EVEN WHEN IT’S RAINING HEAVILY?
- Yes. If there is a commodity inside, just make sure that the ventilator is running and rain water does not go inside.

- 8.13. CAN THE VENTILATORS RUN CONTINUOUSLY?
- Yes. But it depends on battery voltage and weather conditions. Battery should be fully charged before use and weather condition should be clear and sunny. In the case of intermittent weather condition, a fully charged AGM battery that we suggest can last up to 4-5 days.
- 8.14. IS IT NECESSARY TO HAVE THE TOP COVER INFLATED WHEN THERE'S COMMODITY INSIDE THE SBD50?
- Yes, because the top cover protects the commodity especially when it's raining. It also helps in minimizing condensation.
- 8.15. WHICH DIRECTION SHOULD THE SBD50 FACE FOR BEST RESULTS?
- In terms of wind direction, the ventilator should be facing the incoming wind, while the solar panel should be facing South for best exposure to solar radiation.
- 8.16. CAN I SET UP THE SBD50 JUST ABOUT ANYWHERE?
- The SBD can be set up on any relatively flat surface (grassland, rice field, etc.) where there is optimal access to solar radiation.
- 8.17. CAN IT WITHSTAND STORMS AND FLOODS?
- It's not advisable to use the SBD50 during stormy weather though it can prevent water entry into the drying chamber up to a certain extent i.e. less than 10 cm.
- 8.18. HOW LONG DOES IT TAKE TO SET UP THE SBD50?
- It would take about 30 minutes to set it up but that would be dependent on the skills and familiarity of the persons setting up the SBD50.
- 8.19. FOR THE SBD50-SOLAR, WILL THE VENTILATORS STILL RUN EVEN IF THERE'S NO SOURCE OF SOLAR ENERGY?
- If there's not enough energy stored in the AGM battery, the ventilator will automatically stop. The AGM battery is protected by the solar charge controller. When the solar charge controller detects a critical energy level of the battery all devices will stop drawing energy from the battery.
- 8.20. IS IT QUICKER TO DRY IN THE SBD50-ELECTRIC OR IN THE SBD50-SOLAR?
- Drying rate is stable in in the SBD50-Electric because the power supply from the grid is relatively stable. Unlike in SBD50-Solar the energy supply is dependent on the available solar radiation.
- 8.21. IS THERE A DIFFERENCE IN THE QUALITY OF GRAINS AND SEEDS DRIED IN THE SBD50 COMPARED TO REGULAR SUN-DRYING?
- Grains dried in the SBD50 have higher head rice recovery and are free from foreign contaminants i.e. animal excreta, urine, sand, etc.
- 8.22. IS THERE A WAY TO ENSURE THAT THE COMMODITY IS DRIED EQUALLY?
- Yes, by frequently and uniformly mixing the commodity during drying. A 30-minute mixing interval, on the average, is recommended. But a 20-minute mixing interval will be much better and will shorten the drying time.
- 8.23. IS THERE A WAY TO CHECK IF THE COMMODITY IS DRIED TO THE CORRECT MC?
- Yes, by using a calibrated moisture meter for better accuracy of moisture content read outs. But farmers have expertise in determining whether a product is already dry enough for milling or for seeds purposes. Only that they cannot give any exact read outs unlike a moisture meter.
- 8.24. IS THERE ANY DIFFERENCE BETWEEN CROPS DRIED NEAR THE VENTILATOR COMPARED TO THOSE AT THE FARTHER END OF THE SBD50?
- There's a slight, but insignificant moisture content gradient. When the dried commodity is gathered together this moisture gradient equilibrate with the moisture content of the rest.



8.25. DO I NEED TO STORE THE SBD50 WHEN I'M NOT USING IT?

- Yes. When not in use, it's recommended to clean the SBD50 properly fold the top cover and drying floor, and store it in a clean area free from rodents and objects that could damage it.

8.26. WHAT ARE THE MAINTENANCE REQUIREMENTS FOR THE SBD50?

- After using, clean the drying floor and inspect it for cuts or holes. If there are holes or cuts, patch them using the repair tape. Put the SBD50 in its carrying bag and store it out of the reach of rodents, along with its accessories. Avoid dragging the SBD50 drying floor on rough surfaces.

8.27. WHAT IS THE USEFUL LIFE SPAN OF THE SBD50?

- The SBD50 comes with a 1-year warranty for normal wear and tear. However, the SBD50 must be used and taken care of according to the instructions in the manual to last several useful years.

## 9. WARRANTY CLAUSE

GrainPro® hereby warrants that products sold to Buyers shall be free of defects in workmanship and materials, for a period as follows, starting from the date of shipment (B/L): One year for the GrainPro® Solar Bubble Dryer™50 (SBD50).

The warranty liability is limited to replacement of defective products within the warranty period at GrainPro's plant in accordance with the provisions specifically and expressly set forth herein.

The Buyer will pay for Products which need to be replaced under warranty, a percentage of the full list price according to the ratio between the period, which has passed until replacement, and the full warranty period.

The Buyer shall bear shipping costs for shipment of defective Products to GrainPro, and GrainPro shall bear shipping costs of returning good Products to Buyer.

The Warranty does not cover the cost of any service, work, or material required for the replacement of defective Products at the site of installation.

GrainPro shall have no obligation under the warranty to replace defective Products or parts thereof if the defect is a result of any of the following: normal wear and tear; damages occurring after delivery, accidents, acts of God, or catastrophes, fault or negligence, or improper storage installation, maintenance of the Products.

Replacement costs and shipping charges for Products found not to be under warranty as specified above would be paid in full by the Buyer before new/refurbished Products are shipped.

Notwithstanding the above, if the Products include main parts or sub-assemblies purchased by GrainPro from other vendors ("Additional Equipment"), then the period and terms of warranty for Additional Equipment are limited to the period and terms offered by the vendors of such equipment.

The Buyer agrees that the warranty liabilities of GrainPro shall be and are limited to the express foregoing terms: THE EXPRESS WARRANTIES AND OBLIGATIONS SET FORTH ABOVE, ARE AND SHALL BE IN LIEU OF ALL OTHER WARRANTIES AND OBLIGATIONS OF GRAINPRO, and EXPRESSED OR IMPLIED. EXCEPT TO THE EXTENT HEREIN PROVIDED, GRAINPRO DOES NOT MAKE AND SHALL NOT BE DEEMED TO MAKE ANY WARRANTY WHATSOEVER, TO ANY END USER OR TO ANY OTHER PERSON OR PARTY, INCLUDING, WITHOUT LIMITATION, ANY WARRANTY OF MERCHANTABILITY OR OF FITNESS FOR ANY PARTICULAR USE OR PURPOSE. GRAINPRO SHALL NOT BE LIABLE FOR ANY LOSS OF USE, SALES OR PROFIT OR FOR ANY INDIRECT, CONSEQUENTIAL OR INCIDENTAL DAMAGES CAUSED BY OR SUFFERED AS A RESULT OF THE SALE OR USE OF THE PRODUCTS.

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