



THERMO KING

Installation Instructions

ThermoLite™ 110W Solar Panels

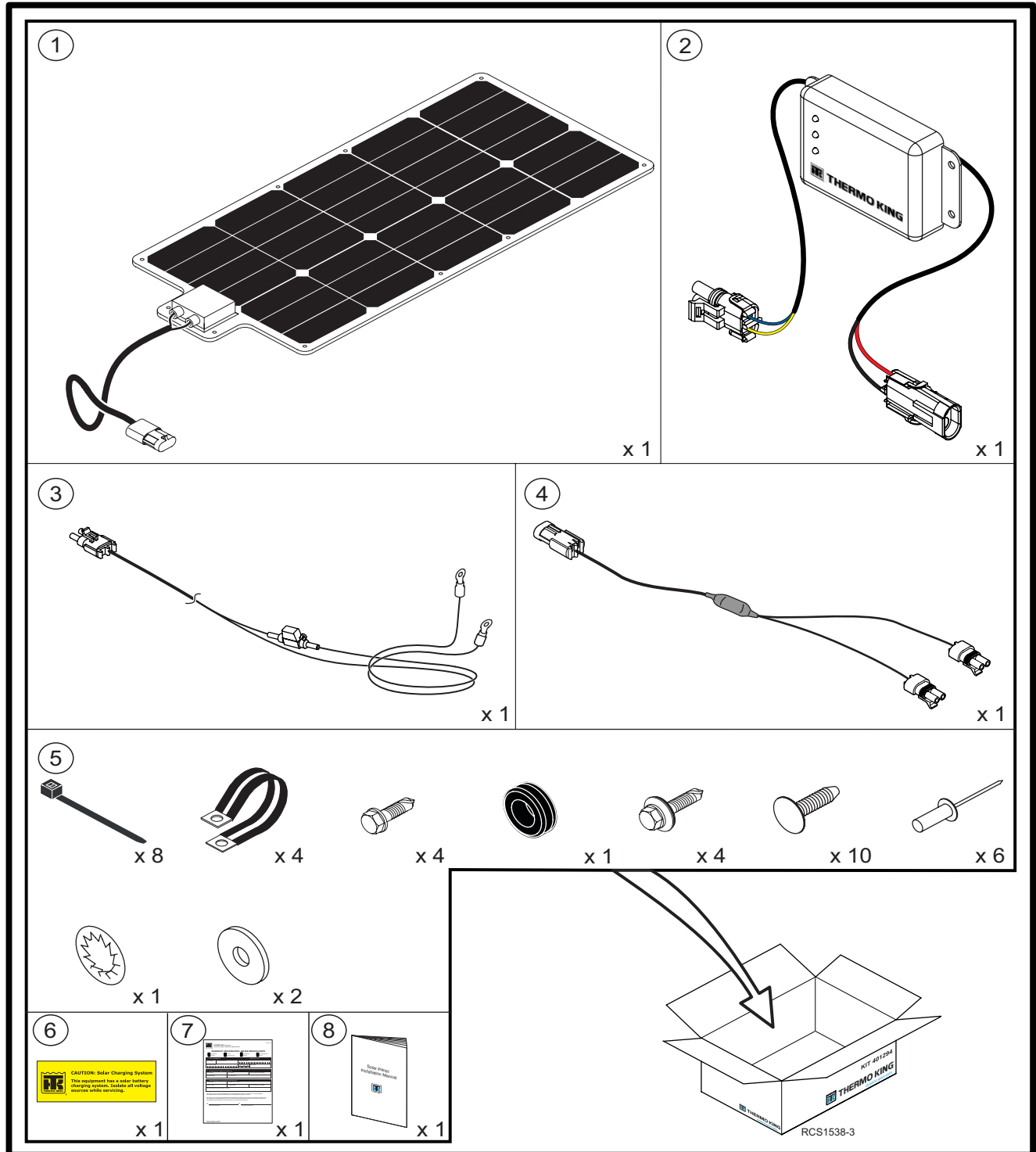
Kits 401417, 401418, 401455, 401741, 401742 and 401744

For the following applications:

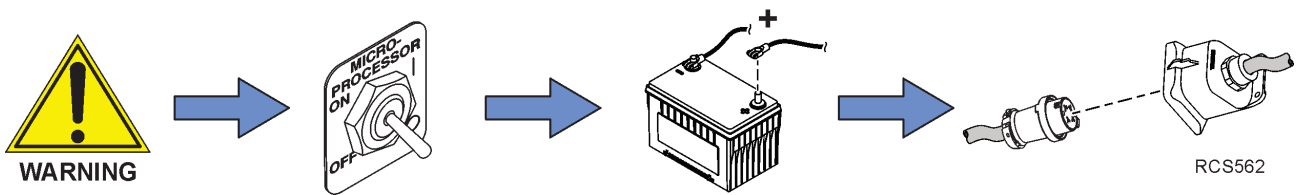
1. Trailer Roof Top Mounted Solar Panel(s)
2. Bus Roof Top Mounted Solar Panel(s)
3. Tractor Fairing Mounted Solar Panel(s) for TriPac Evolution

			401417 Base Kit	401418 Expansion Kit	401455 TriPac Kit	401741 Black Base Kit	401742 Black Expansion Kit	401744 TriPac Black Kit
Item	Description	Part Number	Qty.	Qty.	Qty.	Qty.	Qty.	Qty.
1. 1a.	Solar Panel, 110W Solar Panel, 110W Black	452769 NSS	1	1	1	1	1	1
2.	Charge Controller	422579	1		1	1		1
3.	Fused Battery Harness	422456	1		1	1		1
4.	Y-Expansion Cable	422453		1			1	
5.	Hardware Kit	NSS	1	1	1	1	1	1
6.	Nameplate	NSS	1		1	1		1
7.	Warranty Registration	NSS	1	1	1	1	1	1
8.	Installation Instructions	NSS	1	1	1	1	1	1
Optional Extension Harnesses:								
422405 — 8 ft.								
401293 — 12 ft.								
422406 — 25 ft.					1			1
422407 — 50 ft.								

Figure 1. 110W Solar Panel Kit Components



Solar Panel Installation Best Practices



Important: ***BEFORE** beginning the solar panel installation disconnect all power to the refrigeration unit including standby power (if equipped). Also disconnect all power at the batteries for solar panel installation onto tractors or buses and on trailers equipped with a lift gate.*

⚠ Warning

Personal Protective Equipment (PPE) Required!

A battery can be dangerous. A battery contains a flammable gas that can ignite or explode. A battery stores enough electricity to burn you if it discharges quickly. A battery contains battery acid that can burn you. Always wear goggles or safety glasses and personal protective equipment when working with a battery. If you get battery acid on you, immediately flush it with water and get medical attention.

SOLAR PANEL INSTALLATION REQUIREMENTS

- For the solar panel to adhere properly, both the application surface and air temperature must be above 45 F (7 C).
- All surfaces must be roughened up with sand paper, Scotch-Brite or steel wool and then thoroughly cleaned/dried for the panels to adhere.
- Install panels using the adhesive backing, rivets, cable hold downs and sealant around the panel edges.
- If operating in northern climates with snow and possible snow scrapers, follow installation locations listed to reduce panel damage.
- Periodically inspect the solar system to make sure it still meets initial installation requirements, especially panel attachment.

SOLAR PANEL INSTALLATION BEST PRACTICES

Prior to installation, familiarize yourself with the components supplied in your kit.

Plan the solar panel layout and wire routing prior to permanently mounting any components.

OEM satellite radio antenna's are often mounted in the headliner above the driver towards the windshield. Avoid installing solar panels on the roof directly above the antenna as this will cause reduced radio reception.

DO NOT block the solar panel with antennas, telematics modules, etc. This will greatly reduce the output of the solar panel and inhibit its ability to supply power to maintain and support the battery or batteries it is connect to.

Make sure wire routes are free from abrasive materials and have adequate clearance from hot surfaces.

Holes used for routing harnesses through metal frames, skins or structures should be smooth and non-marring and lined with a grommet.

Remove solar panel fuse (located on the solar panel harness) prior to panel installation.

Tractor with APU – DO NOT connect solar panels to TriPac Envidia APU Batteries.

Solar panel electrical harnesses routed inside the refrigeration unit must be secured to other harnesses or to a solid frame structure with insulated clamps or cable ties to prevent making contact with rotating or hot components.

DO NOT attach electrical harnesses to copper tubing, exhaust components or fuel lines.

Solar Panel Test Procedures must be performed to complete the installation.

Fill out the Warranty Registration Form after completing the installation.

110W Solar Panel Installation Techniques

Adhesive Installation

ThermoLite solar panels utilize a very aggressive adhesive to secure panels to surfaces. This adhesive creates a long-lasting bond that develops its maximum bonding strength 72 hours after installation. The following procedures should be followed to ensure reliability of the adhesion for panel mounting.

Roughing up the Surface

All mounting surfaces should be roughened up using ScotchBrite™ pads, steel wool, or sand paper. The rougher the surface the better the adhesion. Rough up an area 6" greater than the panel.

If surfaces have degraded due to UV and weather exposure, the application and adhesion of solar panels on non-metallic surfaces, even if cleaned thoroughly, may require additional evaluation of adhesion strength. Surfaces showing loose fibers or color fading should be considered to have bond strength reductions.

Figure 2. Roughen surface for best adhesion of solar panel



Cleaning the Surface

Ensure installation location is clean, free of any dirt and cleaner residue. Clean surface with isopropyl alcohol or de-greasers before installing panel. All cleaning residue must be removed and surface completely dry before installing panel. Cleaners other than alcohol require a clean water rinse and then dry. Clean area 6" greater than panel size.

Figure 3. Clean surface thoroughly



Adhering the Panel

Remove adhesive backing paper and firmly press down (13 PSI) over the entire area to ensure the panel is properly adhered to the surface. Press with hands do not use tools; tools may damage the panel internal structure. Testing the adhesive grip after installing the panel by lightly pulling up on the panel is recommended.

Important: For solar panel to adhere properly, both the application surface and air temperature must be above 45 F (7 C) and 120 F (50 C). Adhesive will develop maximum bond strength in 72 hours.

Figure 4. Firmly press panel down over entire area



RCS1494-1

Mechanical Fastening

ThermoLite solar panels have grommets around the edge to provide for mechanical fastening using screws or rivets. All holes **MUST BE FILLED** with sealant before inserting any fastener to ensure a sealed joint. It is also advised to apply sealant over the fastener once installed.

Figure 5. Fastening panel using rivets shown

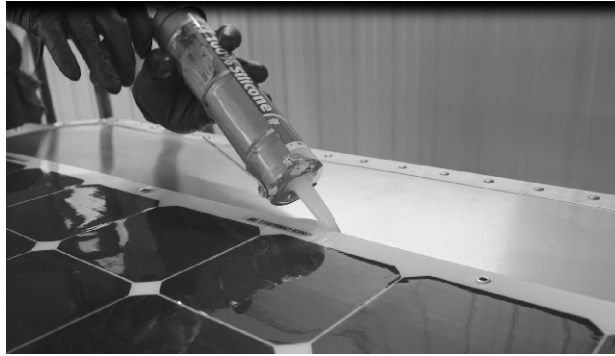


RCS1495

Edge Sealing

Edge sealing is required around the perimeter of the solar panels to prevent wind and liquid from getting under the panel.

Figure 6. Sealing edges of panel shown



RCS1496

Wire Hold Downs

Mechanical clamps must be used to hold the wires as they go over the roof edge into the roof channel. Depending on orientation the first clamp may be in the roof channel. Continue with clamps in the roof channel every 12" until you reach the destination. If not going into a conduit hole in the roof channel then continue down the trailer surface with clamps until you reach the destination.



THERMO KING

110W Trailer Roof Top Installations

Orientation Options

Important: *BEFORE beginning the installation, refer to “Solar Panel Installation Best Practices,” p. 3 and “110W Solar Panel Installation Techniques,” p. 4.*

Important: *If operating in northern climates with snow and possible snow scrapers, the front installation is the recommended location. Snow scrapers will generally miss the junction box and wires at the front trailer edge due to their V design. Make sure to discuss the snow scraper equipment used on the trailer before finalizing installation strategy.*

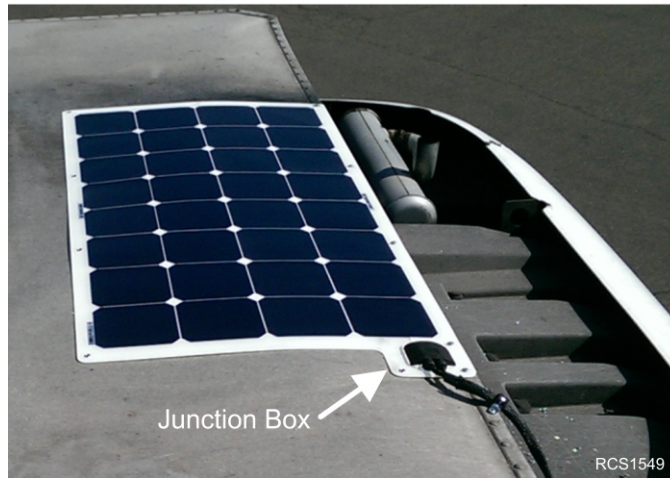
Plan your installation before starting to make sure things line up.

- 110W panels are about 45” long X 22” wide with 22” wire leads.
- Y-harnesses to connect more than one panel together
- Extension harnesses are available in various lengths and go from either 1 panel or the Y-harness end down to your batteries or battery connection. One end of the extension harness has the connector loose so that it can be pulled through conduit.

Front Orientation

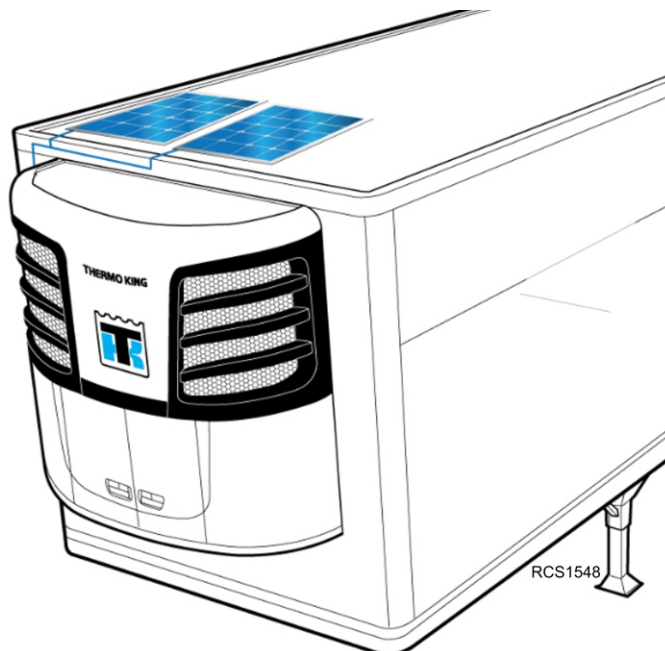
A single 110W panel should be placed with the long side to the trailer front so that it can be riveted along the front edge. A clamp should be used on the top roof rail and also inside the rail to hold the wire slightly away from the trailer roof edge. Clamps should be used as needed to minimize loose cables in the channel. Place panel away from refrigeration unit exhaust (if present).

Figure 7. Single 110W panel front installation shown



Two or three 110W panels should be placed with the short side to the trailer edge so rivets can go along the trailer edge. Leave about 1" between panels and center across the roof. A clamp should be used inside the roof rail to hold the panel cable away from the roof edge. Clamps should be used as needed in the channel on the harnesses. Place panel away from refrigeration unit exhaust (if present).

Figure 8. Two 110W panel front installation shown

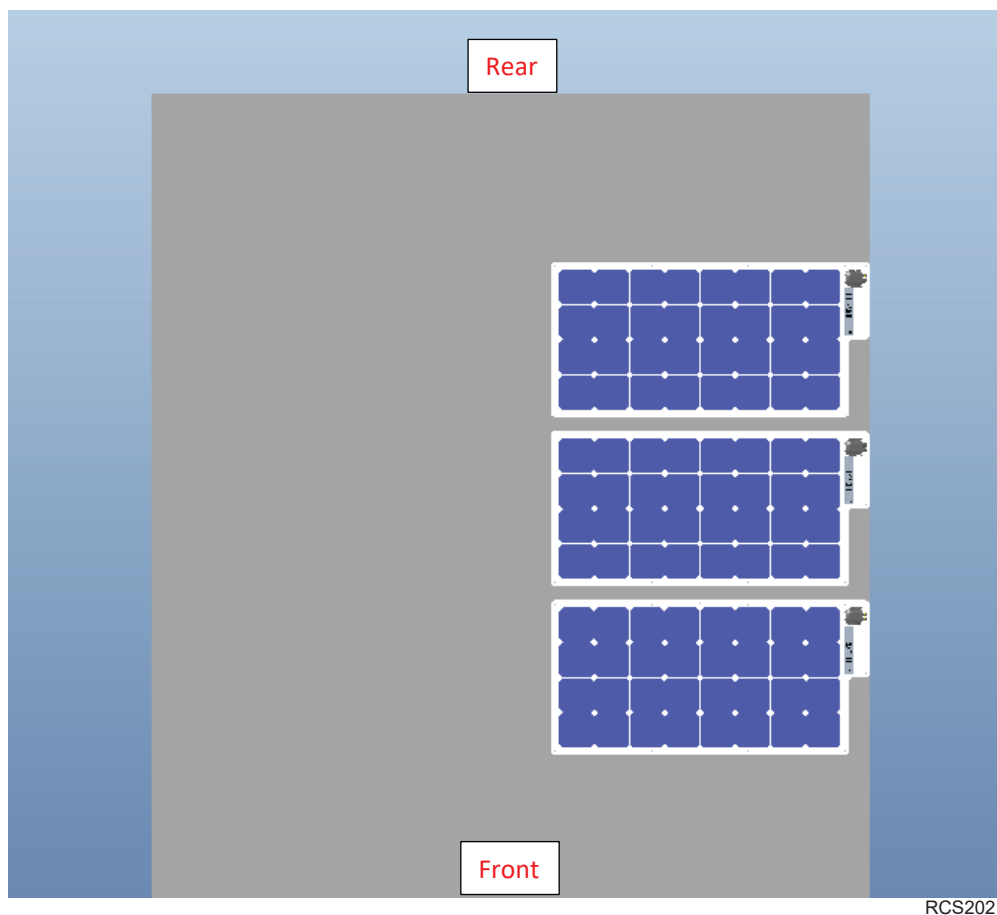


Rear/Mid Orientation

Important: *If operating in northern climates with snow and possible snow scrapers, the front installation is the recommended strategy. The rear/mid orientation strategy is not recommended as a snow scraper is more likely to hit the junction box and possibly the harnesses.*

One, two or three 110W panels should be placed with the short side to the trailer edge so that the cables quickly go over the edge, the rivet holes align with the edge and also a ramped edge of the junction box faces forward. Allow at least 2 feet from the trailer rear to avoid the dock seal and allow more sunlight when parked at the dock. A clamp should be used inside the roof rail to hold the panel cable away from the roof edge. Clamps should be used as needed in the channel.

Figure 9. 110W panel rear/mid orientation shown



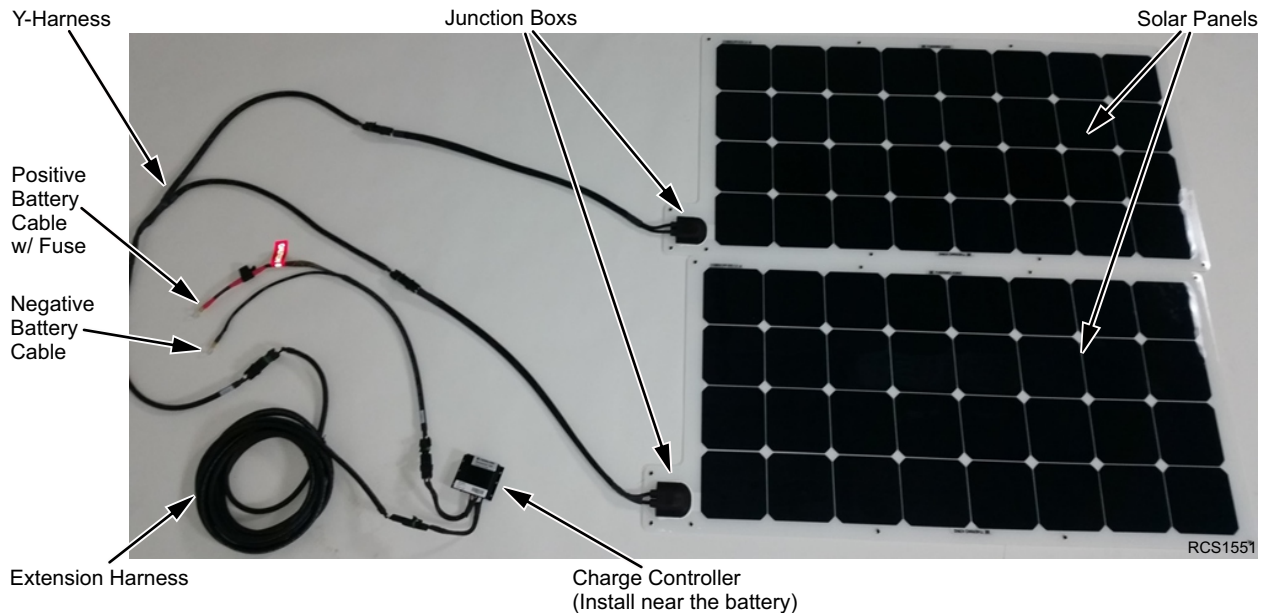
Side Channel Wiring

Clamps should be used to hold the harnesses in the channel. Clamp as needed. When using the Y-harnesses with multiple panels, clamp one wire and tie wrap to overlapped cables. The extension harness is then routed through the trailer conduit and connected.

Installation Steps

Important: BEFORE beginning the installation, refer to “Solar Panel Installation Best Practices,” p. 3 and “110W Solar Panel Installation Techniques,” p. 4.

Figure 10. Typical solar panel components shown



1. Select and layout panel orientation. Mark panel edges so you know where to rough up roof surface.
 2. Plan harness routing taking into account rough edges. Make sure wire routes are free from abrasive materials and have adequate clearance from hot surfaces. Any holes through metal frames, skins or structures should be smooth and non-marring or be lined with a grommet prior to routing wires.
 3. Rough up roof surface 6" greater than panel size.
 4. Clean the roof surface where you roughed it up.
 5. Line up panel so overlapping rivets can go through trailer edge.
 6. Carefully remove adhesive on the back of the panel and press down with no more than 13 lbs. of force (more may break the internals).
 7. Drill holes (appropriate size for rivets) where panel grommet holes line up with roof rail. Fill with sealant caulk in the roof hole and over the rivet.
 8. Add rivets along roof edge through the panel grommet holes and apply sealant caulk on top.
 9. Apply sealant caulk around all edges of the panel.
 10. Route harness over roof edge and use clamps as needed.
- Important:** The harness should not rub on the roof edge. Use clamps so that the wire does not rub on the roof edge.
11. Connect and route Y-harness (if utilized) and extension harnesses. Use clamps as needed.
 - a. Maximum of three (3) 110W panels connected in parallel.
 - b. Utilize the Y-cable(s) (if necessary) to connect multiple panels together in parallel.

12. Secure any excess cable off the roof if possible. Any rooftop cables should be secured using mechanical fasteners, p-clamps or high-bond adhesives.
13. The extension harnesses are provided with one non-plugged end and a loose connector housing. Verify the polarity of the cable to the panel and charge controller prior to routing the wire. Plan your route and route the wiring starting with the non-plugged end.
14. Route the extension harness through existing wall conduit or down the front or back of the trailer.
 - a. Add grommets to holes in frame or skins as needed to protect wiring.
 - b. Route towards the battery box or connections to the batteries to be charged using existing cables.
 - c. After solar harness routing through battery box grommet, seal the grommet hole with caulk to prevent water getting inside.
 - d. Do not route the cable next to any heat sources or any sharp edges without adequate clearance or additional cable protection.
 - e. If the cables are routed through new or existing holes in metal structures, grommets (installer provided) must be used to protect the cables.
15. Secure the charge controller near the batteries.

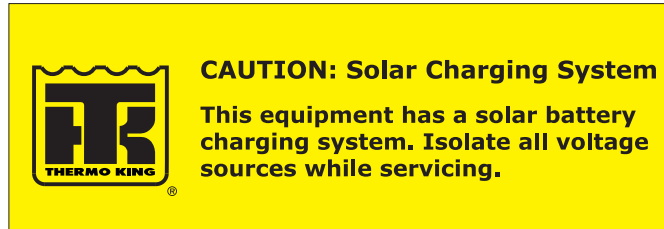
Figure 11. Secure Charge Controller near batteries



16. Once the wiring is in place, take the loose connector end provided and plug the white wire into position "A" and the black wire into position "B".
 - a. Pull back slightly on the wire after hearing a "click" to make sure the terminal is properly seated.
 - b. Fold the retainer clip onto the back of the connector until you hear a "click". Make sure the retainer clip is secured.
17. Connect the extension harness to the charge controller.
18. Connect the battery terminal harness to the charge controller and route the white/red wire to the positive terminal on the battery.
 - a. If multiple batteries are being supported, when possible put the battery terminal leads across the battery bank by attaching the red wire to the positive post on one battery and the black wire to the negative post on the far opposite battery.
19. Attach the black wire to the negative ground of the battery or to a common ground stud or terminal.

20. Clean surface and attach supplied nameplate on the lift gate battery box or near the solar panel terminal connection. The label must be visible to servicing technicians to warn of additional charging sources.

Figure 12. Install nameplate in a visible location



21. Reinstall fuse in solar wire harness and reconnect all battery connections.

22. Perform “[ThermoLite Charge Controller](#),” p. 21 to complete the installation.

23. Fill out the Warranty Registration Form after completing the installation.

Note: Depending on the installation, all kit components may not be used.

Bus Roof Top Installations

Important: BEFORE beginning the installation, refer to “Solar Panel Installation Best Practices,” p. 3 and “110W Solar Panel Installation Techniques,” p. 4.

Note: It is recommended that one 110W solar panel be installed for each bus battery.

1. Thoroughly prepare surface per “110W Solar Panel Installation Techniques,” p. 4. Failure to properly prepare mounting surface will result in poor adhesive strength of the solar panel.
 - a. Maximum of three (3) 110W panels connected in parallel.
 - b. Utilize the Y-cables to connect multiple panels together in parallel.

Figure 13. Typical bus installation shown.

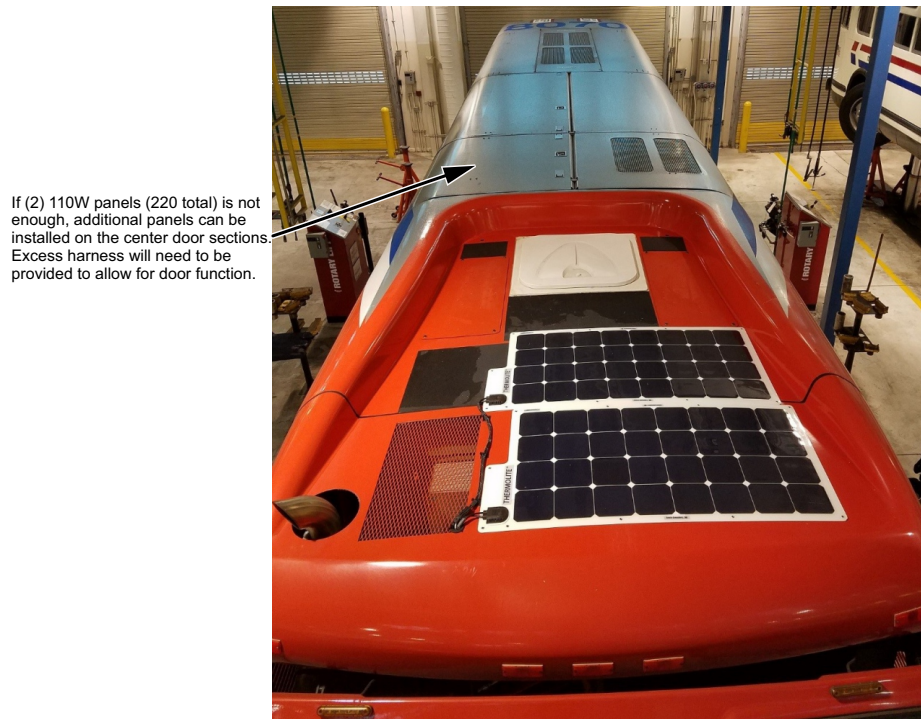
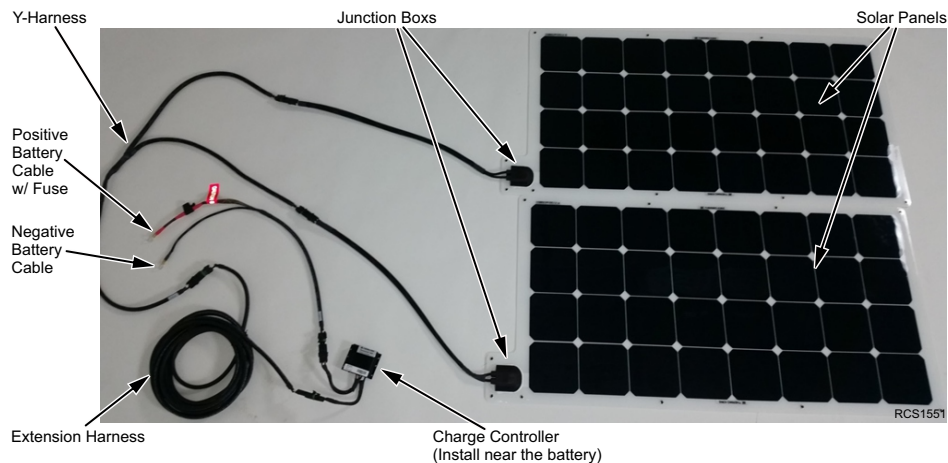


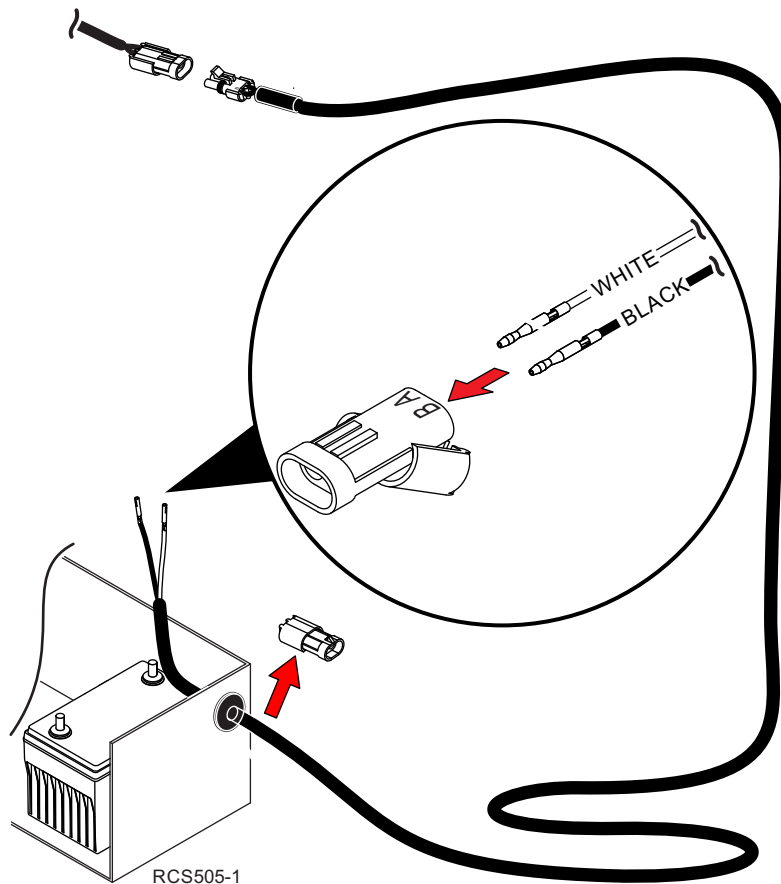
Figure 14. Typical components shown.



Extension Harnesses Connections

2. Extension harnesses are provided with one non-plugged end and a loose connector housing. Verify the polarity of the cable to the panel and charge controller prior to routing the wire. Plan your route and route the wiring starting with the non-plugged end.
3. Attach 25 ft. extension harness to the solar panel connector and route harness down the front or back of the bus and through an existing doors/panels and into the battery compartment.
4. Remove 2-pin connector (attached to harness) and route harness through a rubber grommet and into tractor's battery box.
5. Attach 2-pin connector to harness by releasing the locking tab, inserting wires until they are fully seated, and closing locking tab securely.
 - White wire (B+) into socket A
 - Black wire (B-) into socket B

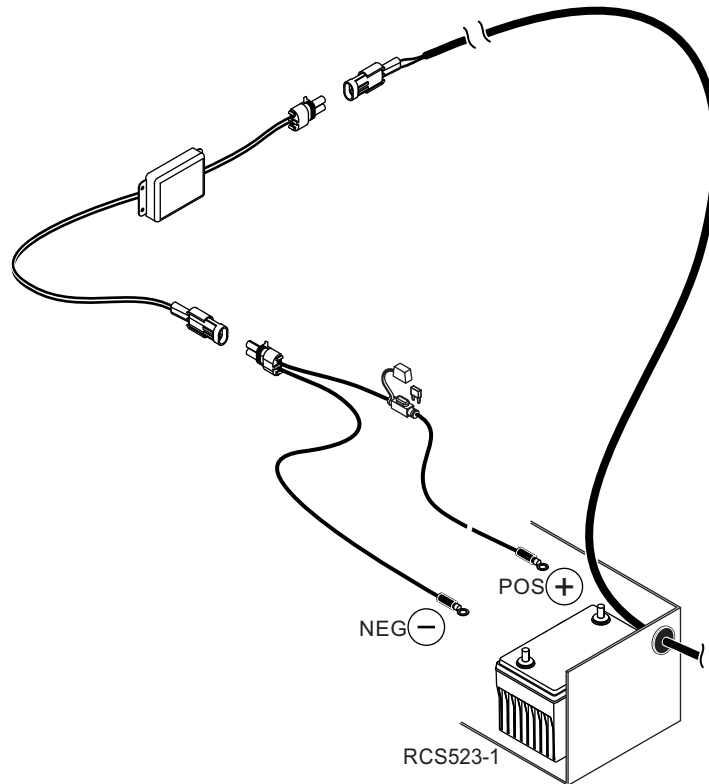
Figure 15. Extension harness to battery connections shown.



Charge Controller and Battery Harness Connections

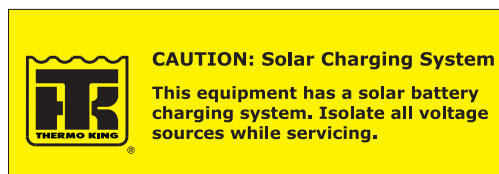
6. Connect charge controller to extension harness.
7. Remove fuse from battery harness and connect to charge controller.
8. Connect terminal rings from battery harness to battery:
 - Black to Negative (-)
 - White to Positive (+)

Figure 16. Charge Controller and Battery Harness Connections shown.



9. Secure controller inside battery compartment.
10. Clean surface and attach supplied nameplate near the battery box or the solar panel terminal connection. The label must be visible to servicing technicians to warn of additional charging sources.

Figure 17. Install nameplate in a visible location.



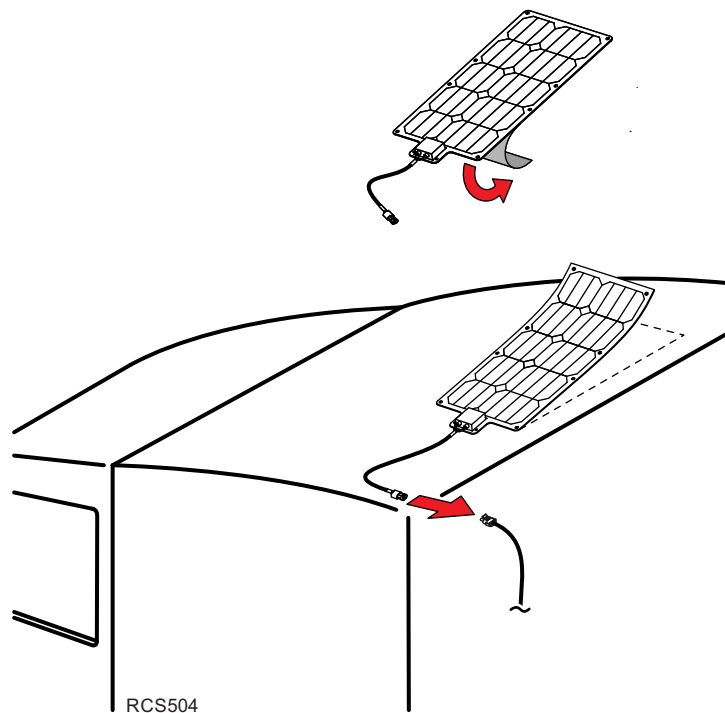
11. Install fuse in solar wire harness and reconnect all battery connections.
 12. Perform "Test Procedures," p. 22 to complete the installation.
 13. Fill out the Warranty Registration Form after completing the installation.
- Note:** Depending on the installation, all kit components may not be used.

Class 8 Tractor Cab Installation

Important: BEFORE beginning the installation, refer to "Solar Panel Installation Best Practices," p. 3 and "110W Solar Panel Installation Techniques," p. 4.

1. Thoroughly prepare surface per "110W Solar Panel Installation Techniques," p. 4. Failure to properly prepare mounting surface will result in poor adhesive strength of the solar panel.
2. Position solar panel onto roof of the cab and away from the exhaust exit.
3. Peel back the top 4 inches of the backing paper and begin to apply panel to surface.
4. With panel properly positioned, remove remainder of backing paper and firmly press panel down over the entire area. Repeat several times to ensure the entire panel is properly adhered to the surface. This is critical to prevent moisture between the surfaces.

Figure 18. Peel back backing paper and position solar panel on to roof



Class 8 Tractor Cab Installation (continued)

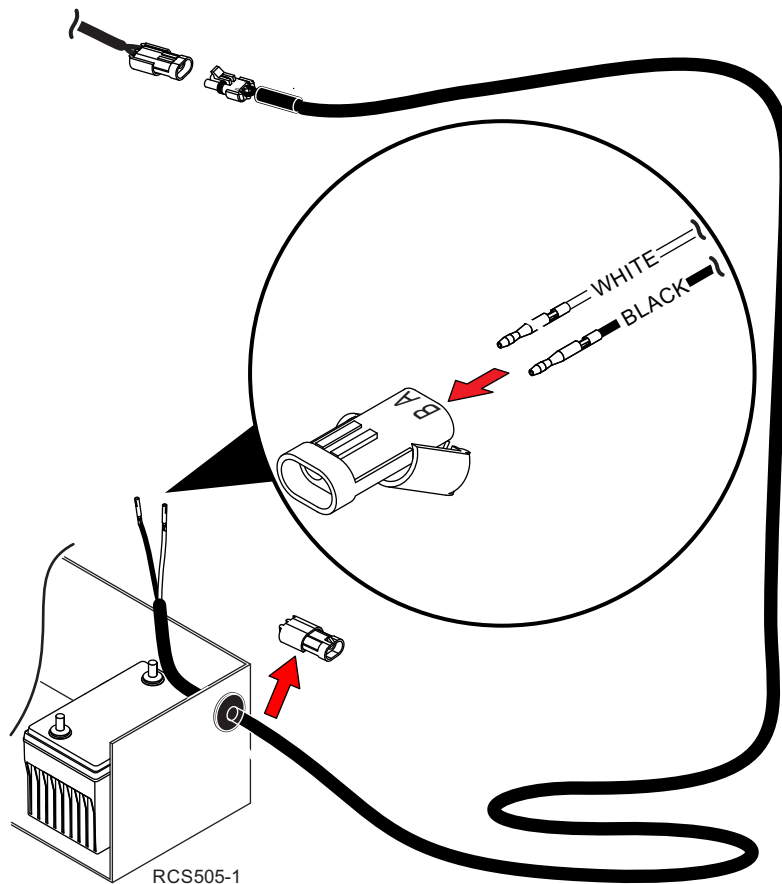
Extension Harnesses Connections

5. Extension harnesses are provided with one non-plugged end and a loose connector housing. Verify the polarity of the cable to the panel and charge controller prior to routing the wire. Plan your route and route the wiring starting with the non-plugged end.
6. Attach 25 ft. extension harness to the solar panel connector and route harness down the rear of the cab and over to the tractor's batteries.
 - a. Secure harness with supplied clamps and band wraps.

Important: Allow slack in the extension harness going from the cab to the tractor's frame to allow for normal cab movement.

7. Remove 2-pin connector (attached to harness) and route harness through a rubber grommet and into tractor's battery box.
8. Attach 2-pin connector to harness by releasing the locking tab, inserting wires until they are fully seated, and closing locking tab securely.
 - White wire (B+) into socket A
 - Black wire (B-) into socket B

Figure 19. Extension Harness to Battery connections shown



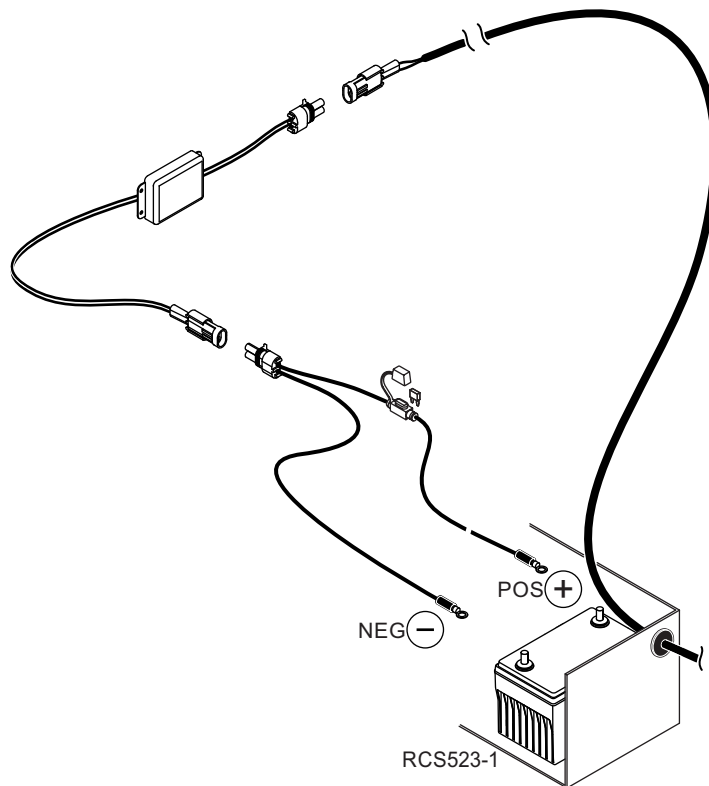
Class 8 Tractor Cab Installation (continued)

Charge Controller and Battery Harness Connections

9. Connect charge controller to extension harness.
10. Remove fuse from battery harness and connect to charge controller.
11. Connect terminal rings from battery harness to **TRACTOR BATTERIES ONLY**:
 - Black to Negative (-)
 - White to Positive (+)
12. Secure controller inside battery compartment.
13. Clean surface and attach supplied nameplate near the battery box or the solar panel terminal connection. The label must be visible to servicing technicians to warn of additional charging sources.
14. Reinstall fuse in solar panel battery harness and reconnect all battery connections.
15. Perform “[Test Procedures](#),” p. 22 to complete the installation.

Note: Depending on the installation, all kit components may not be used.

Figure 20. Charge Controller and Battery Harness Connections shown

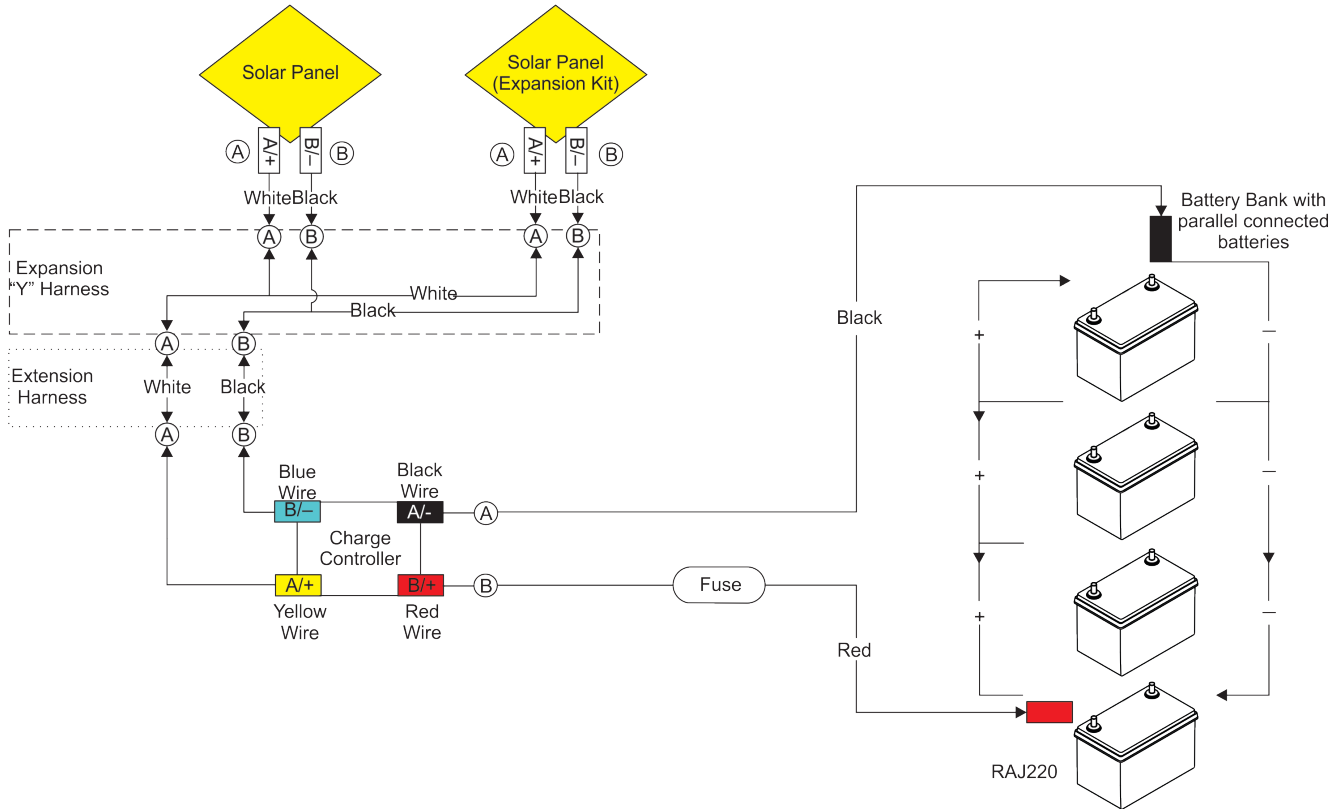


IMPORTANT!
Connect Solar Panel(s) to Tractor Batteries ONLY.
DO NOT Connect to TriPac ENVIDIA APU Batteries.

Wiring Diagrams

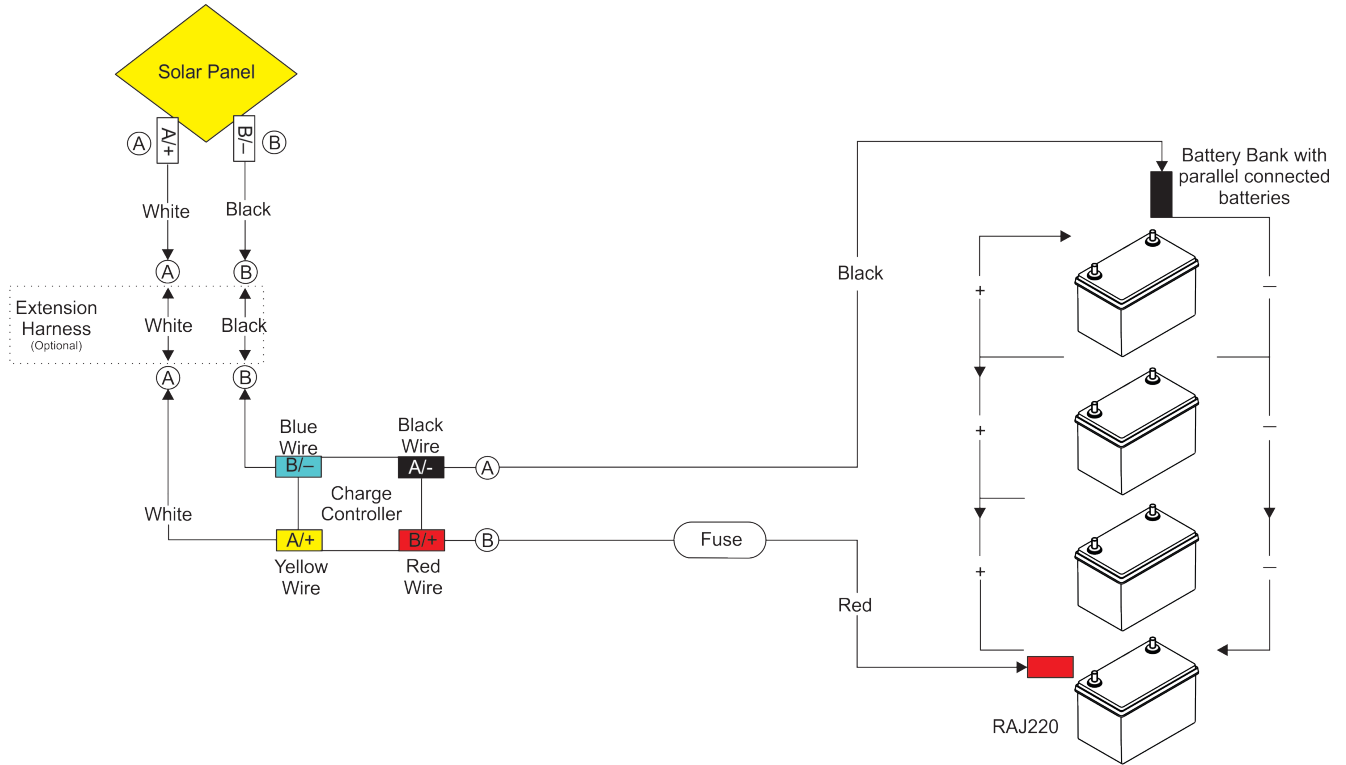
Wiring Diagram: Expansion Panel Wiring

- Ⓐ **Terminal A** - is always positive + on the Solar Panel side of the charge controller.
- Ⓑ **Terminal B** - is always positive + on the Battery side of the charge controller.



Wiring Diagram: Single Panel Wiring

- Ⓐ **Terminal A** - is always positive + on the Solar Panel side of the charge controller.
- Ⓑ **Terminal B** - is always positive + on the Battery side of the charge controller.



ThermoLite Charge Controller

The 20amp charge controller comes with one LED status light that indicates battery charging and system operation. You can use the Status Light Function table below to verify solar panel operation. You can also use the Test Procedure on the next page. Additionally see "Solar Panel Trouble Shooting Guide" if necessary.



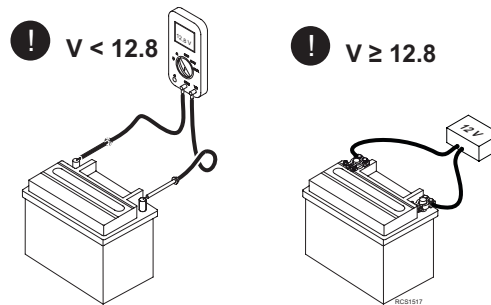
STATUS LIGHT FUNCTION
Flashing Green = Battery charging / Controller connected correctly.
Solid Green = Controller connected to battery / Solar input may or may not be connected correctly*
No Light = Controller not connected / extremely low or dead battery.
<i>*Status light will illuminate solid green even if harness is connected in reverse. Ensure status light is flashing green to verify correct installation.</i>

Test Procedures

To properly test the solar output you must have the following items:

- Halogen lamp (500W or greater) or be outdoors in the daylight.
 - Voltage meter
 - Amp clamp or Ammeter
1. Attach voltmeter on the battery and measure the voltage.
 - Voltage must be less than 12.8V for the solar panel controller to turn on.
 - If battery voltage is not less than 12.8V, then put a 12V load on the battery.

Figure 21. Measure battery voltage

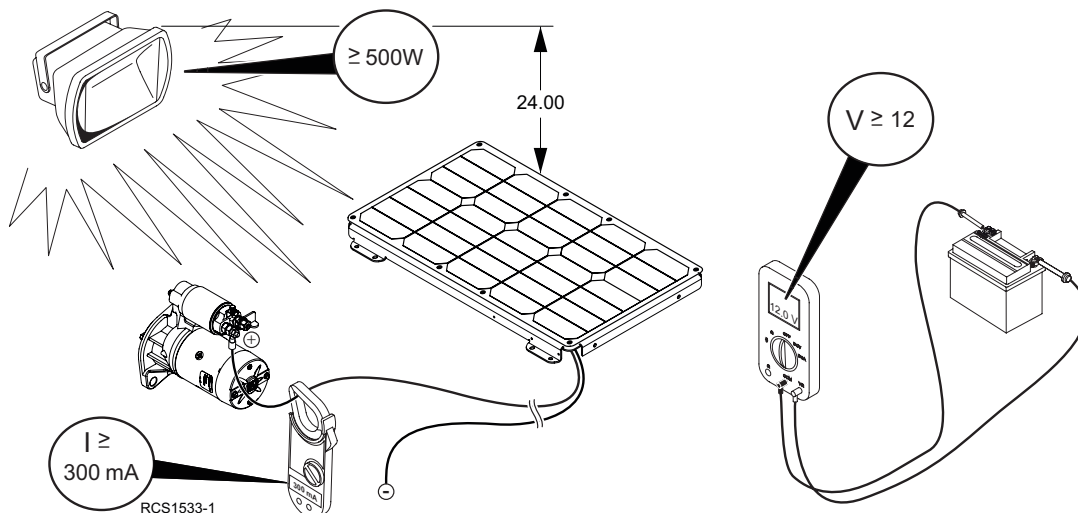


2. Move vehicle outdoors into the daylight. If indoors, put at least a 500W halogen lamp approximately 24" above the solar panel and turn lamp on.

Note: The solar panel controller may take up to a minute to turn on. The solar panel must be connected to the battery in order to turn on the charge controller.

3. Attach voltmeter on the battery and measure the voltage.
 - a. Voltage reading should begin increasing or stay the same.
4. Place amp clamp around the positive cable from the solar panel.
 - a. Amperage reading should be greater then 300 mA.

Figure 22. Measure solar panel voltage and amperage readings



Solar Panel Troubleshooting Guide

Use the following table to troubleshoot ThermoLite Solar Panel Systems.

STEP	ACTION	RESULT	COMMENT
1	Verify the system is connected to a battery.		The system will not operate if not connected to a battery.
2	Verify the battery voltage is between 11V & 12.6V	Either discharge or charge the battery to the range for the solar charge controller to operate	The solar controller will only operate if the battery voltage is within the range of 11V to 12.6V.
3	Verify system operation by exposing the panel to sufficient light.	Any amount of sunlight (even cloudy day) will result in some current (>100mA) flowing to the battery. This must be verified with an amp clamp around the positive cable to the battery.	If tested inside, at least 500W of halogen light at a range of about 12-24" should be used. Ensure the light shines on the entire panel.
4	Check if the fuse is present in the harness and verify continuity		Ensure any replaced fuse is rated at 20A.
5	Is the solar charge controller present in the system (applies to 36 & 100W systems)?	Once connected, the charge controller will take up to 1 minute to turn on and start charging. At this point current will be flowing.	The absence of a charge controller will result in unregulated power input to the battery that could under or overcharge the battery.
6	Verify cable polarity using the diagrams provided in the installation instructions TK 56127 and TK 56237 (applies to 36 & 100W systems).	Cable Polarity is swapped in the controller so the polarity from start to finish must be checked. If polarity is found to be wrong, swap the pins in the extension cable.	This is a common issue during installation if the connector is installed backwards and the polarity isn't checked.
7	Confirm cable integrity	Check cable integrity to ensure that abrasions, scrapes, or breaks in the wire are not affective voltage drop or power loss.	Breaks in the power cable anywhere along the line will result in voltage or power loss that will result in ineffective charging.
8	Verify solar panel output (without charge controller) by disconnecting the panel from the harness and checking voltage output at the panel plug connector.	Unregulated panel output voltage may range from approximately 17V to 21V. If the panel has low output voltage then it's defective and should be replaced.	Testing the panel output will isolate the issue in the system.
9	Confirm charge controller functionality.	With the panel in sunlight the system should put out at least 200mAmps.	If all above tests are confirmed then use an Amp clamp with at least 3 decimal points around the positive cable going to the battery.



ThermoLite™ Solar Panel Kit Warranty

All ThermoLite solar panels installed by an authorized Thermo King dealer and registered within the first twelve (12) months of installation receive five (5) years parts and labor warranty coverage from date of installation. ThermoLite solar panels installed by an authorized Thermo King dealer not registered in that time will automatically receive five (5) years plus 90 days parts and labor coverage from date of manufacture.

Customer installed ThermoLite solar panels registered within the first twelve (12) months of installation receive five (5) years parts warranty coverage from date of installation. Customer installed ThermoLite solar panels not registered in that time will automatically receive five (5) years plus 90 days parts coverage from date of manufacture.

Customer Satisfaction Survey

Let your voice be heard!

Your feedback will help improve our manuals. The survey is accessible through any internet-connected device with a web browser.

Scan the Quick Response (QR) code or click [Technical Publications TK Americas Feedback](#) to complete the survey.

