THERMO KING

Installation Instructions

ThermoLite™ 110W Solar Panels

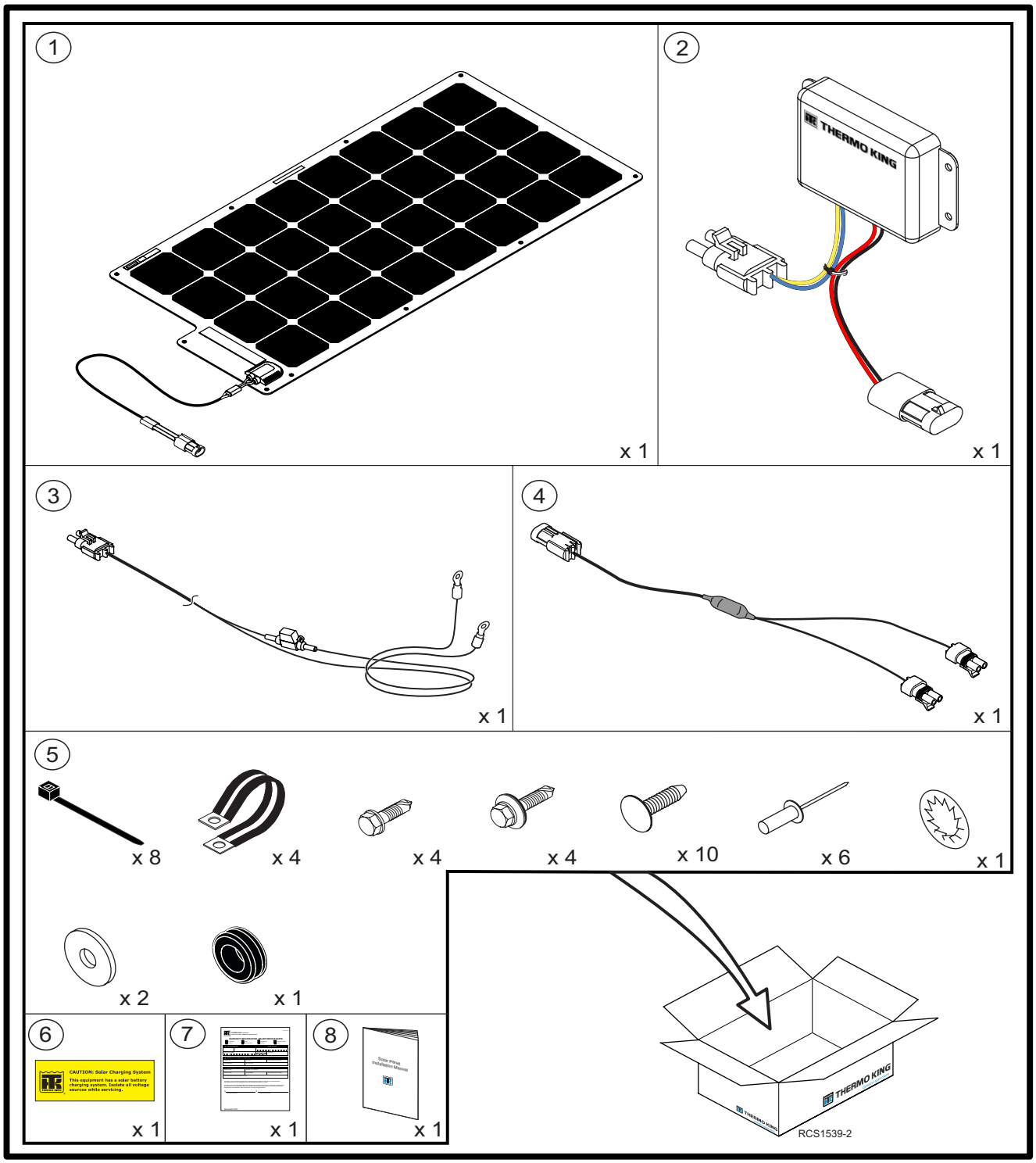
Kits 401417, 401418 and 401455

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)
4. TriPac

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

Figure 1. 110W Solar Panel Kit Components



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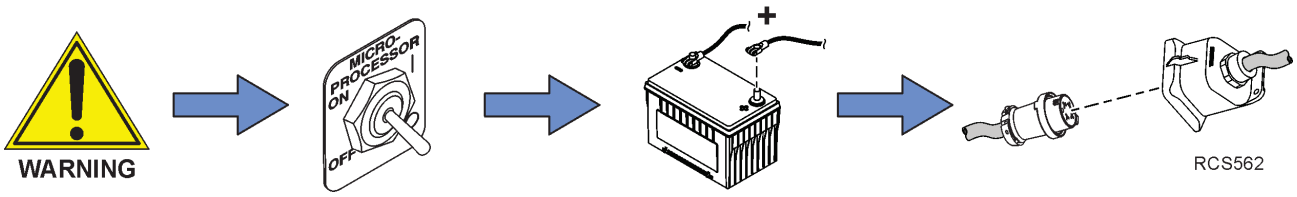
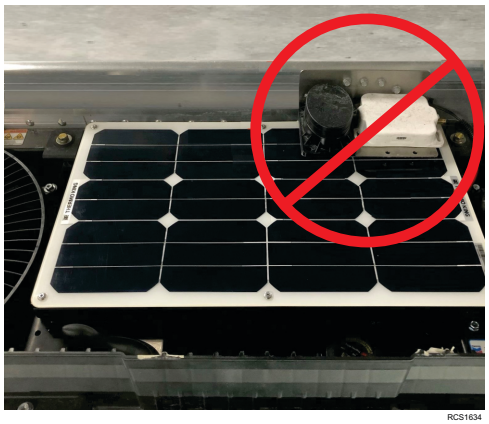
Solar Panel Installation Best Practices



Important: *<u>BEFORE</u> 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*

- Prior to installation, familiarize yourself with the components supplied in your kit.
- Follow installation instructions specific to your installation kit and model refrigeration unit.
- Plan the solar panel layout and wire routing prior to permanently mounting any components.
- 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.

Figure 2. DO NOT block the solar panel with antennas, telematics modules, etc.



Installing Solar Panels with Adhesive Backing

Note: *If panel is intended to be removed in the future, use only mechanical fasteners to secure.*

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.

Surface Preparation

Smooth fiberglass surfaces such as those used in Class 8 Tractors & Transit Buses often utilize a heavy gloss or contain mold release wax. This significantly affects the solar panels ability to adhere properly to the surface. All mounting surfaces should be roughened up using Scotch-Brite™ pads, steel wool, or sand paper. The rougher the surface the better the adhesion.

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. Mechanical fasteners and edge sealing should be added.

Figure 3. Roughen surface for best adhesion of solar panel

Cleaning the Surface

Ensure installation location is clean and free of any dirt. Clean surface with isopropyl alcohol or appropriate de-greasers before installing panel. All cleaning residue must be removed and surface completely dry before installing panel.

Figure 4. Clean surface thoroughly

RCS1493

Adhering the Panel

Remove adhesive backing paper and firmly press down (15 PSI) over the entire area to ensure the panel is properly adhered to the surface. This is critical to prevent moisture between the surfaces. Testing the adhesive grip after installing the panel by lightly pulling up on the panel is recommended. Mechanical fastening is encouraged whenever possible while edge sealing is strongly recommended as it is extremely beneficial to the quality and reliability of the adhesives bond.

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 5. 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. It is advised when possible that all installations utilize at least one type of mechanical fastener to ensure panels do not come loose. 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.

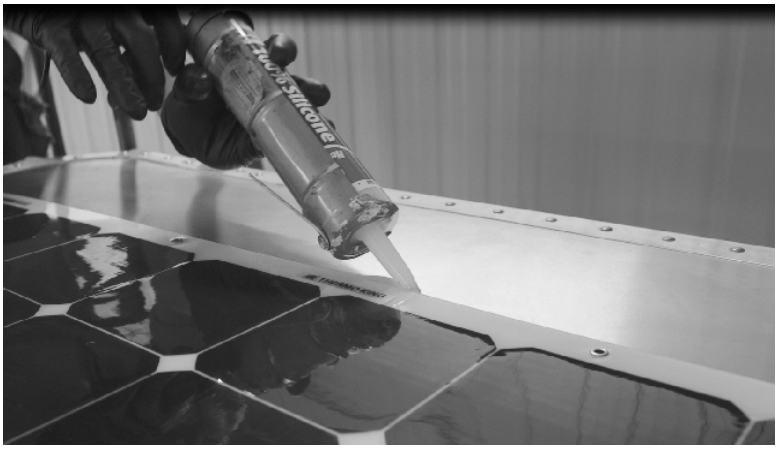
Figure 6. Fastening panel using rivets shown

RCS1495

Edge Sealing

Edge sealing is strongly recommended around the perimeter of the solar panels as it helps prevent water and debris from entering under the panels and is extremely beneficial to the quality and reliability of the adhesives bond.

Figure 7. Sealing edges of panel shown



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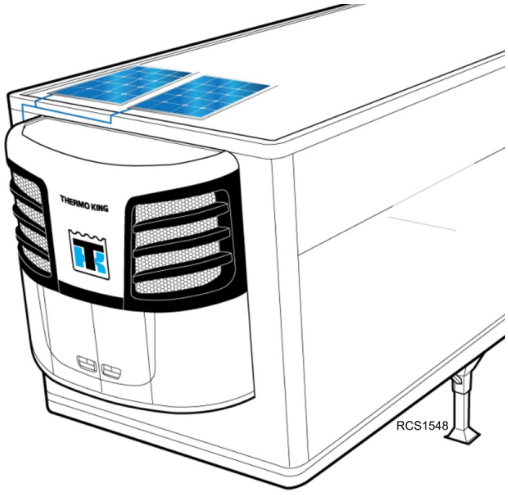
Trailer Roof Top Installations

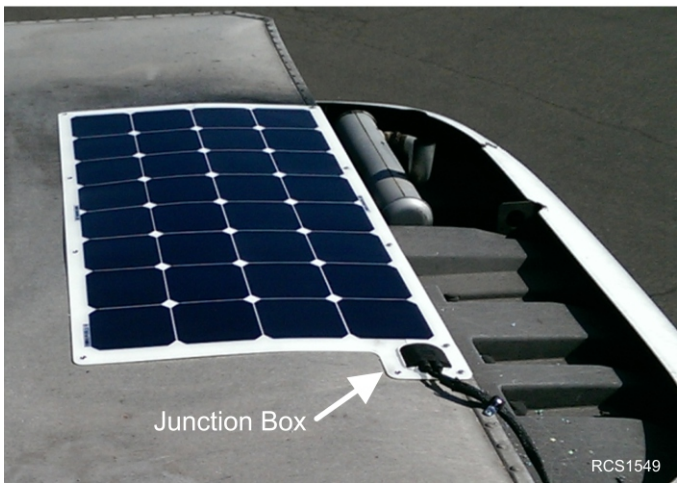
Important: *BEFORE beginning the installation, refer to* *"Solar Panel Installation Best Practices," p. 3*.

Figure 8. Two panel installation shown.



1. Thoroughly prepare surface per **"Installing Solar Panels with Adhesive Backing," p. 4** Failure to properly prepare mounting surface will result in poor adhesive strength of the solar panel.
2. Solar panel installation can be either the front or back of the truck box or trailer.

Figure 9. Single panel installation shown.



   a. If refrigeration unit is present with existing two-pole (two wire) connections with a wire gauge of 12 AWG or larger to the liftgate batteries, then the panels should be installed on the roof of the trailer near the front to utilize the existing connectors.
   b. Front of trailer installations are generally preferred so vehicles parked against a building will not shade the solar panels and reduce performance.
   c. Considering installing the solar panels away from the tractor and refrigeration unit exhaust systems. The panel may be positioned length wise or perpendicular to the trailer

roof edge. Exhaust soot build-up on the panel can result in decreased performance if not cleaned off regularly.

d. The junction boxes should be positioned closest to the edge of the trailer end and lined up with planned wire route.

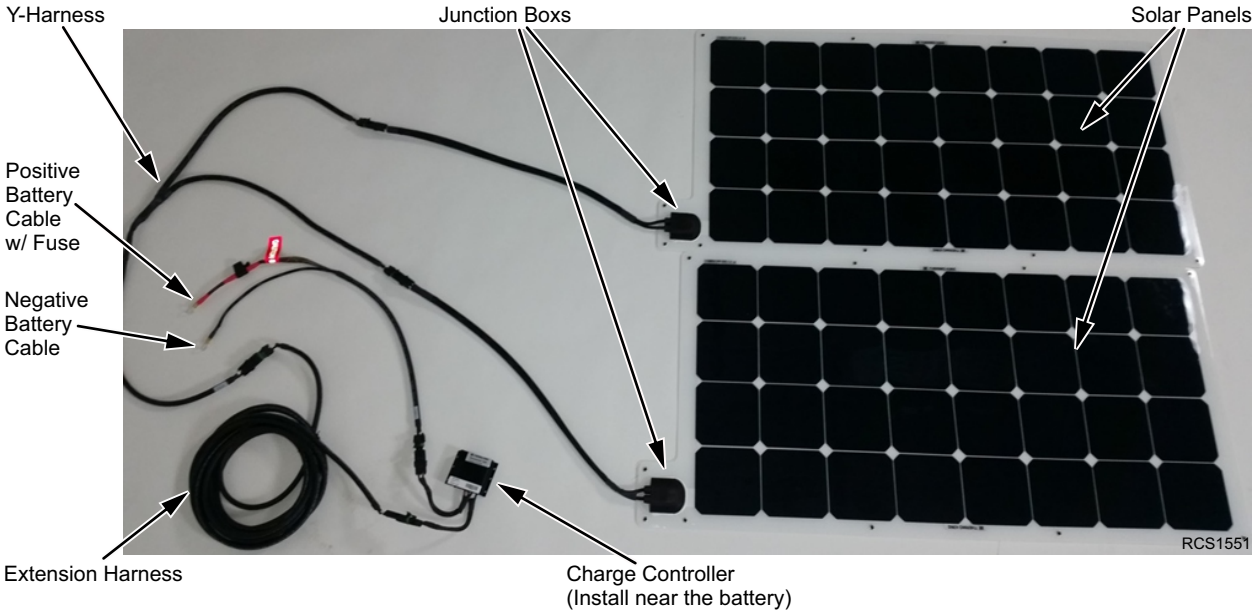
e. If scrapers are to be used for winter snow removal, position the panel with the long edge containing the junction box aligned to the front edge of the trailer so the sloped edge of the junction box is facing forward.

f. If the battery box is located at the very rear of the trailer, the solar panel(s) could be located at the rear of the trailer with protected cable routing down the back.

Figure 10. Panels shown installed at rear or trailer.

3. Plan the panel layout and wire routing prior to permanently mounting any equipment. Familiarize yourself with the components to be installed. 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.

Figure 11. Typical components shown.



a. Maximum of three (3) 110W panels connected in parallel.
b. Utilize the y-cables to connect multiple panels together in parallel.

4. Secure any excess cable off the roof if possible. Any rooftop cables should be secured using mechanical fasteners, p-clamps or high-bond adhesives.
5. 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.
6. Route the extension harness down the front or back of the trailer and through any existing conduits if possible.
   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.
7. Verify that any existing cables used meet or exceed the wire gauge of the wiring supplied with the solar panels.
   a. Do not route the cable next to any heat sources or any sharp edges without adequate clearance or additional cable protection.
   b. If the cables are routed through new or existing holes in metal structures, grommets (installer provided) must be used to protect the cables.
8. Secure the charge controller near the batteries or adjacent to the existing two pole front of trailer connection points using mechanical fasteners.

Figure 12. Secure Charge Controller near batteries.

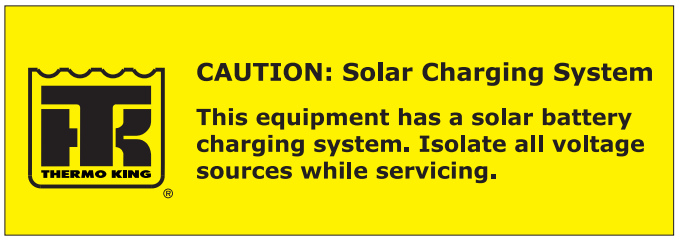
9. Once the wiring is in place, take the loose connector end provided and plug the white wire into position “A” and the black wire into position “B”.
   a. Pull back slightly on the wire after hearing a “click” to make sure the terminal is properly seated.
   b. Fold the retainer clip onto the back of the connector until you hear a “click”. Make sure the retainer clip is secured.
10. Connect the extension harness to the charge controller.
11. Connect the battery terminal harness to the charge controller and route the white/red wire to the positive terminal on the battery or to the two pole connection location. If existing wiring is to be utilized it must meet or exceed the 12 AWG wire gauge of the wiring supplied with

the solar panels.

Note: *NOTE: If the existing wiring quality or gauge is in question, add additional new solar panel extension cables as needed and route the panel wiring to the battery box location and install the charge controller and battery harness at the battery box location as seen in* ***Figure 7****.*

12. Attach the black wire to the negative ground of the battery or to a common ground stud or terminal.
13. 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 13. Install nameplate in a visible location.



14. Reinstall fuse in solar wire harness and reconnect all battery connections.
15. Perform "Test Procedures," p. 20 to complete the installation.
16. 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*.

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

1. Thoroughly prepare surface per **"Installing Solar Panels with Adhesive Backing," 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 14. Typical bus installation shown.

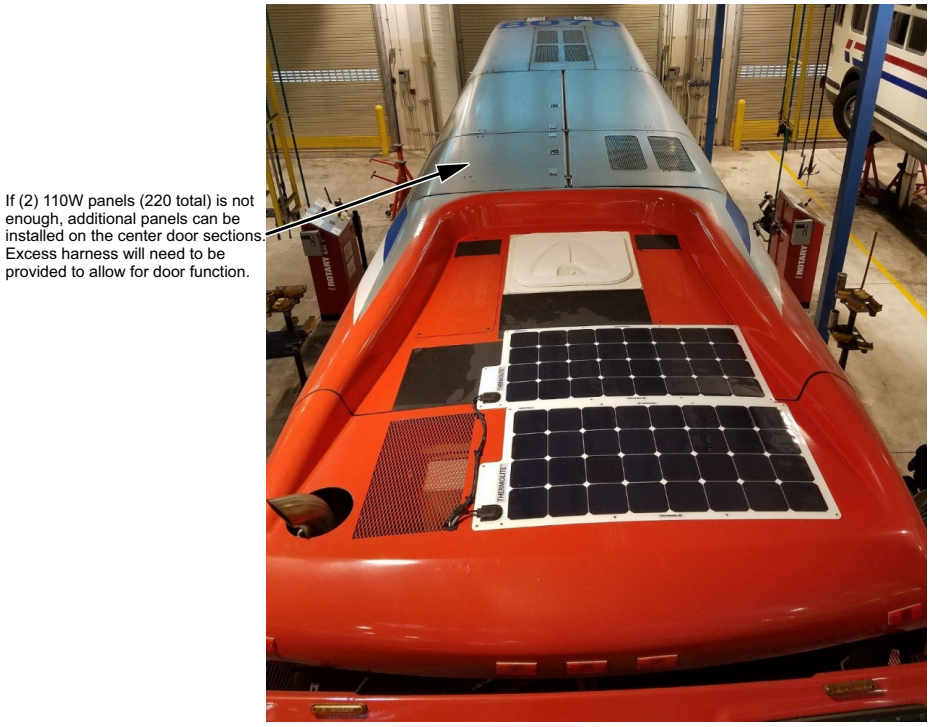
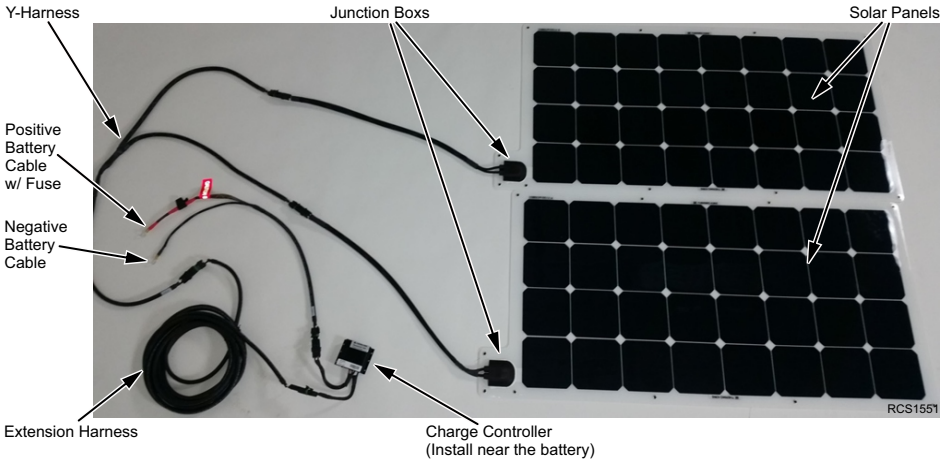


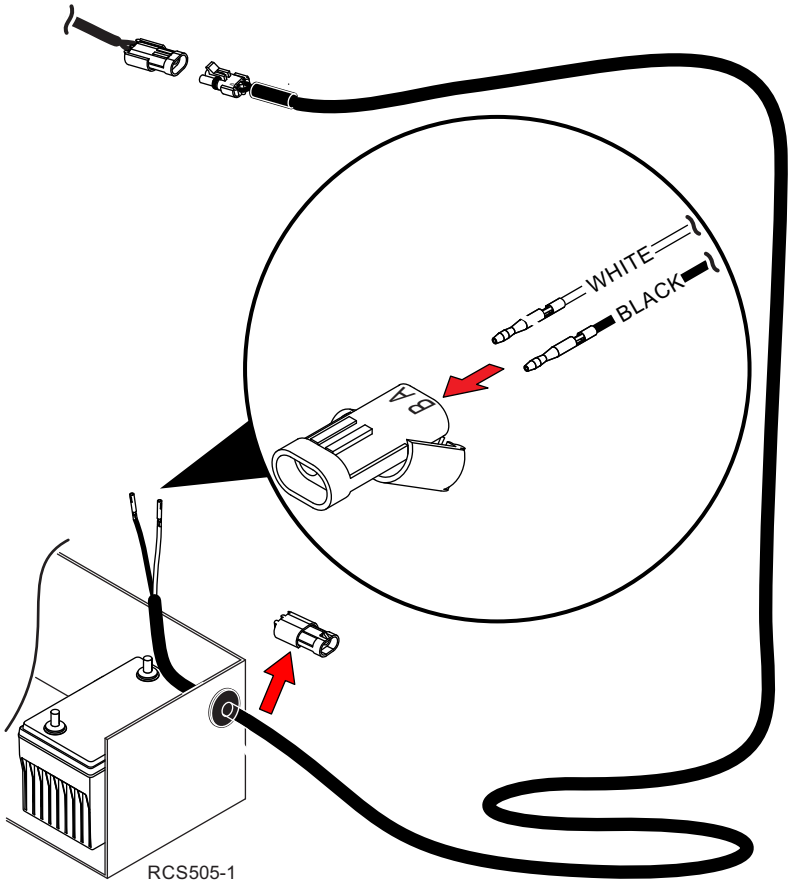
Figure 15. Typical components shown.



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

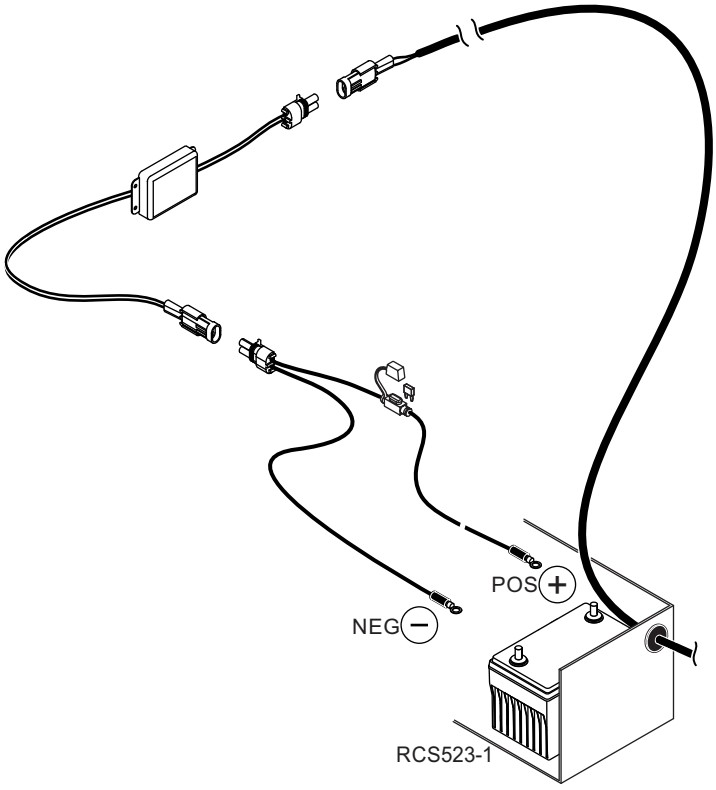
Figure 16. Extension harness to battery connections shown.



Charge Controller and Battery Harness Connections

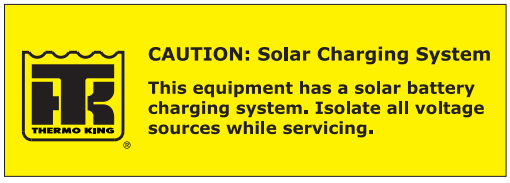
6. Connect charge controller to extension harness.
7. Remove fuse from battery harness and connect to charge controller.
8. Connect terminal rings from battery harness to battery:
   - Black to Negative (-)
   - White to Positive (+)

Figure 17. 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 18. Install nameplate in a visible location.



11. Install fuse in solar wire harness and reconnect all battery connections.
12. Perform "Test Procedures," p. 20 to complete the installation.
13. Fill out the Warranty Registration Form after completing the installation.

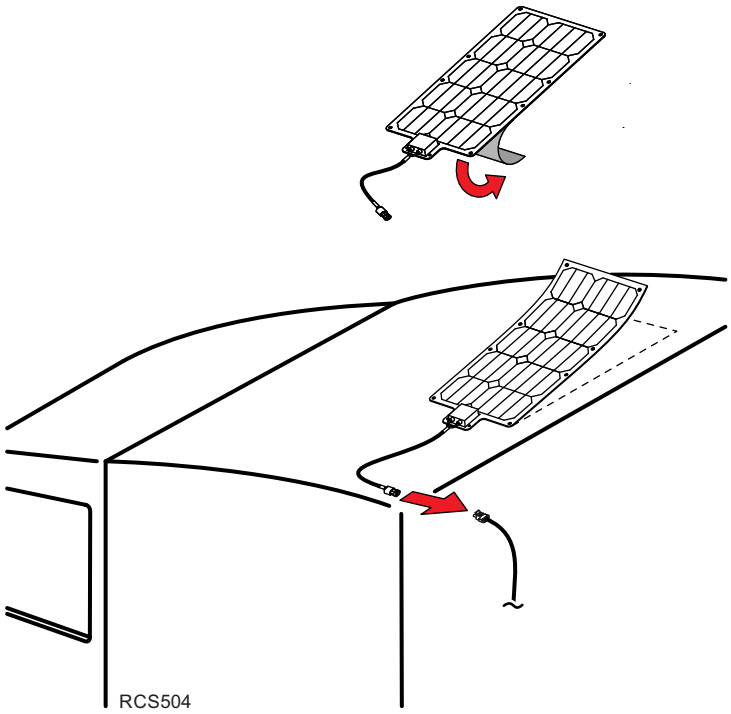
Note: *Depending on the installation, all kit components may not be used.*

Class 8 Tractor Cab Installation

Important: *BEFORE beginning the installation, refer to "Solar Panel Installation Best Practices," p. 3.*

1. Thoroughly prepare surface per **"Installing Solar Panels with Adhesive Backing," 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 — 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 19. Peel back backing paper and position solar panel on to roof



Class 8 Tractor Cab Installation (continued)

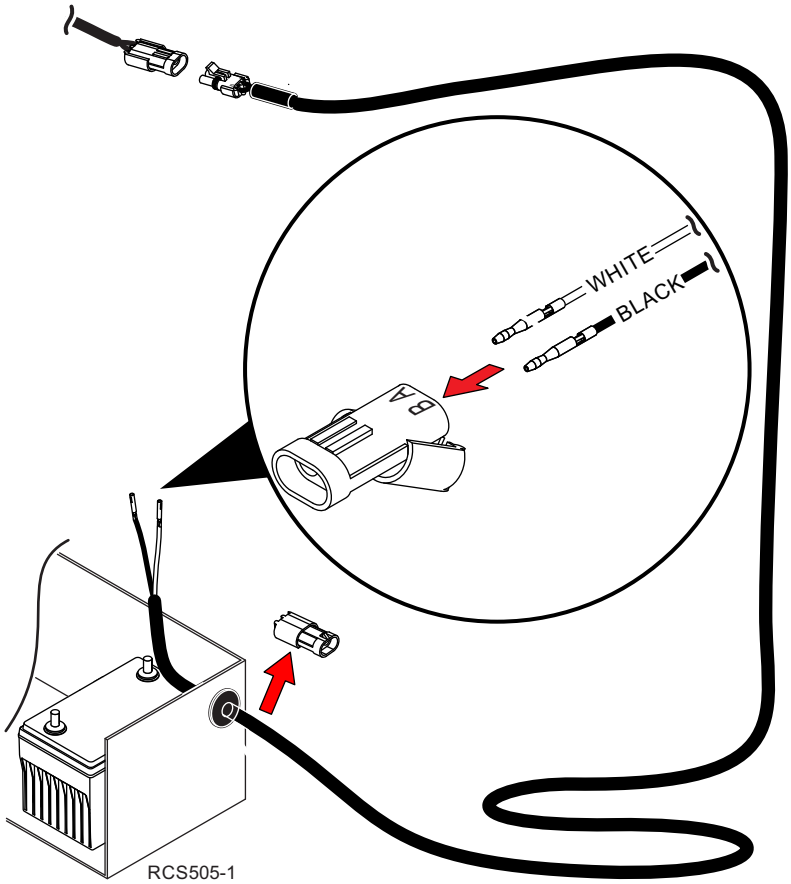
Extension Harnesses Connections

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 20. Extension Harness to Battery connections shown



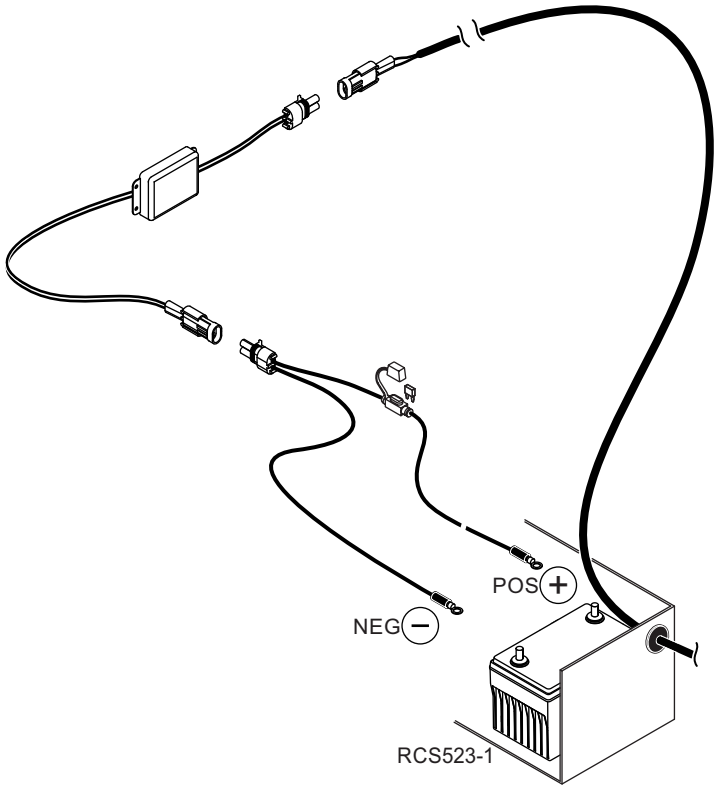
Class 8 Tractor Cab Installation (continued)

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. 20 to complete the installation.

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

Figure 21. Charge Controller and Battery Harness Connections shown



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

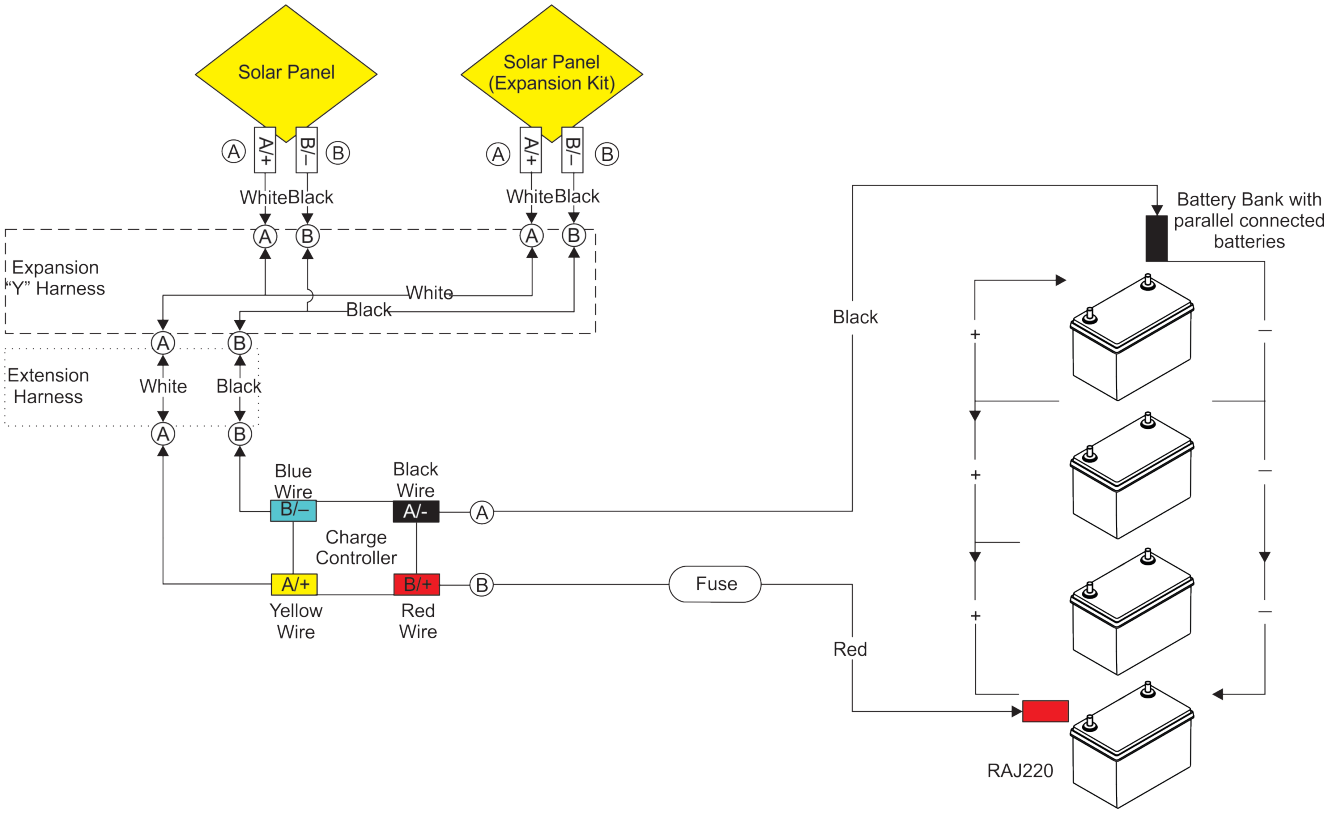
Expansion Panel Installation and Wiring Guide

1. Place additional panel(s) in their chosen locations and mount according to the instructions.
2. Connect provided parallel y-cable(s) together and secure using brand wraps and clamps.
   - Up to 72W may be connected into a single 5amp charge controller.
   - Up to 400W may be connected into a single 20amp charge controller.

Wiring Diagram: Expansion Panel Wiring

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

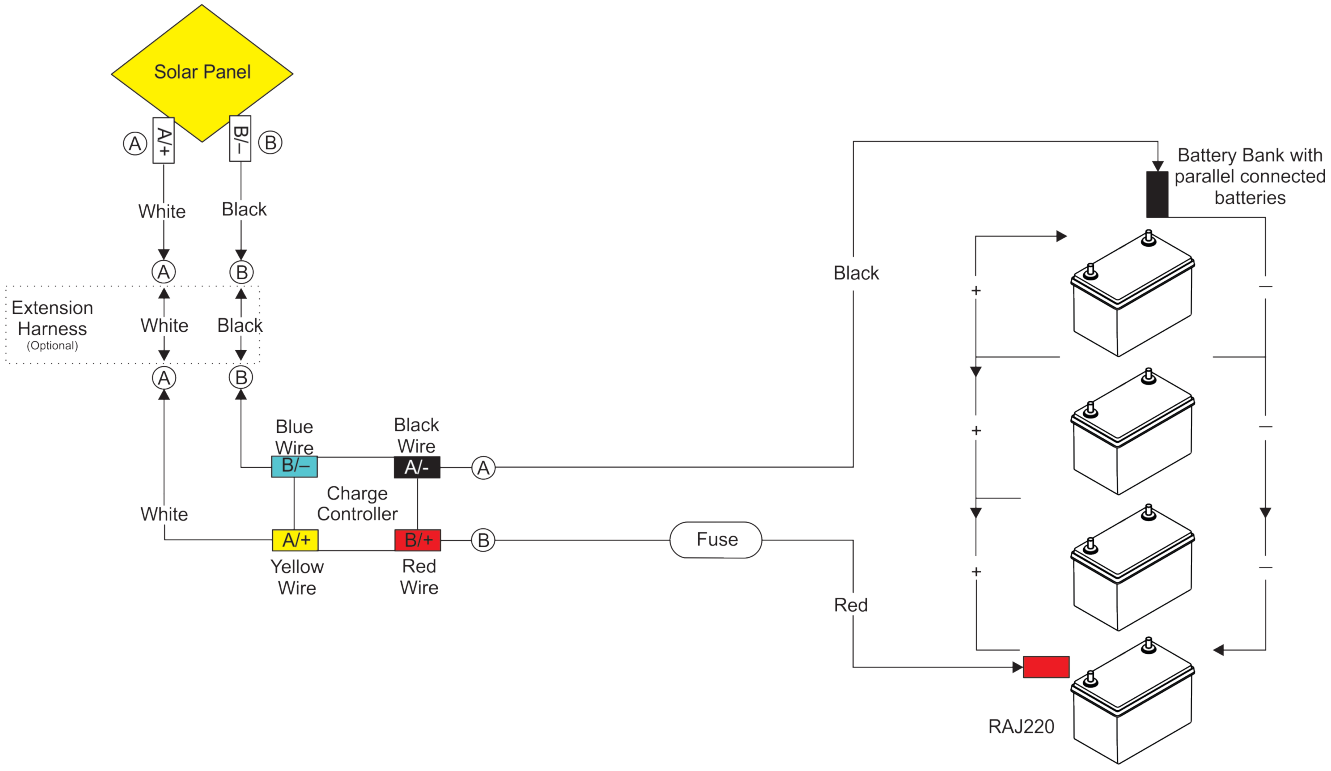
Ⓑ **Terminal B -** is always positive + on the Battery side of the charge controller.



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.
***Status light will illuminate solid green even if harness is connected in reverse. Ensure status light is flashing green to verify correct installation.**

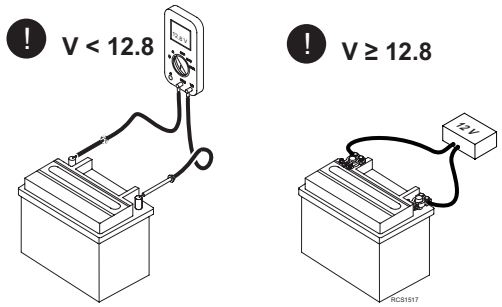
Test Procedures

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 22. Measure battery voltage

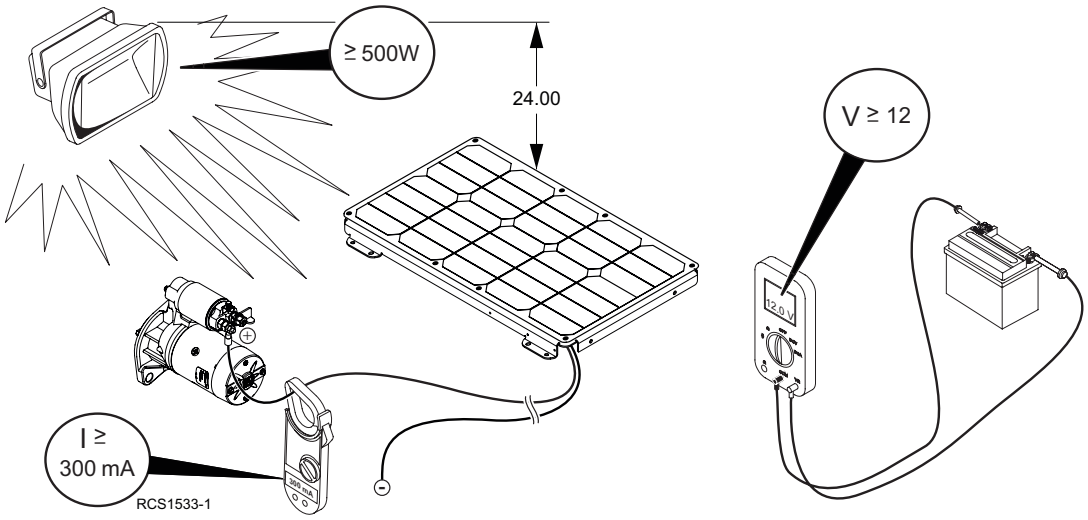


2. Move vehicle outdoors into the daylight. If indoors, put at least a 500W halogen lamp approximately 24'' above the solar panel and turn lamp on.

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 23. Measure solar panel voltage and amperage readings



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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 or type the web address https://tranetechnologies.iad1.qualtrics.com/jfe/form/SV_2octfSHoUJxsk6x?Q_CHL=qr&Q_JFE=qdg to complete the survey.