

WARP CORE BATTERY SYSTEM

Owner's manual



LOGIC
DIVE GEAR
Nellis Engineering, Inc.

!!! READ THIS !!!

IT IS IMPERATIVE TO READ AND FOLLOW THIS MANUAL EXACTLY.
IF YOU LACK THE TECHNICAL ABILITY TO PERFORM THE PROCEDURES,
DO NOT ATTEMPT AND CONTACT THE FACTORY FOR GUIDANCE.

The Warp Core Battery System is NOT IDIOT PROOF and no attempt was made to try to make it idiot proof. Damage to the Battery Management System (BMS), wiring, circuit boards and cells **WILL OCCUR** if procedures are not followed **EXACTLY**. This includes **CONNECTING AND DISCONNECTING IN PROPER SEQUENCE**. There are over 246 possible mistakes that you can make and only one correct assembly and disassembly sequence. That means you have a 99.6% chance of making a mistake if you do not follow the directions **EXACTLY**.

DO NOT TRY TO MEMORIZE ANY ASSEMBLY OR DISASSEMBLY SEQUENCE. READ THE ENTIRE PROCEDURE FIRST, TO FAMILIARIZE YOURSELF WITH THE STEPS BEFORE BEGINNING. RE-READ EACH INDIVIDUAL STEP BEFORE PERFORMING IT.

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Changes to the manual

Changes to the manual from the previous revision can be identified by a vertical black bar in the left margin, where the change occurs.

Warnings & Cautions

WARNING

A warning means that injury or death is possible if the instructions are not obeyed.

CAUTION

A caution means that damage to equipment is possible.

Note

A note is added to give more information, usually in a procedure.

WARNING: Mishandling Lithium Ion cells can result in fire and energetic release of material if short circuited, physically damaged or over heated. Do not short circuit, drop, crush or expose the cells to temperatures above 140°F (60°C)

WARNING: Do not leave the DPV batteries (alone or installed in DPV) in direct sunlight or a hot car. Temperatures of 158°F (70°C) or above can result in fire or energetic release of material.

WARNING: A maximum voltage of 74.8VDC is present on exposed contacts, when the Warp Core Battery is assembled. Care should be taken not to touch exposed contacts when the battery is removed from the protection of the DPV Body.

WARNING: Never allow the batteries to charge unattended or attempt to charge a damaged battery. The Lithium Ion batteries have a high energy density and can catch fire or explode if abused or damaged. Only recharge in a safe location, free of flammable materials, under direct supervision and only using the supplied charger. Do not attempt to charge the batteries immediately after fully discharging them at a high power setting. The batteries heat up the most during the end of a deep discharge and should be allowed to cool for one hour before recharging.

WARNING: Do not attempt to charge the batteries when they are at or below freezing (32°F/0°C). Permanent damage to the batteries will result, decreasing both battery safety and capacity. While the outside of the batteries may be above freezing, the centers may not. Ensure ample time is spent in a warm environment for thermal equilibrium across the pack before charging, following exposure to freezing temperatures.

CAUTION: Avoid running the DPV until battery cutout. Deeply discharging the battery shortens the battery life and can lead to over-discharge of the batteries. Should the DPV be run until cutout, remove the recharge plug cover on the nose of the DPV after exiting the water and recharge the batteries at your earliest opportunity.

Travel and Shipping

If you received your battery or DPV via ground transportation, the Warp Core Battery should already be assembled and ready to use. If you received your battery via air transport, such as FedEx Express or DHL, your battery layers were disconnected for transport. Follow the procedures below IN THE EXACT SEQUENCE for assembly. Read each step completely BEFORE performing.

Removing Battery from DPV Body

1. Remove two thumbscrews and rotate two black locking bars out of groove in gray bar, so battery can be removed, then reinstall thumbscrews in holes to prevent losing them. (Figures 1 & 2)

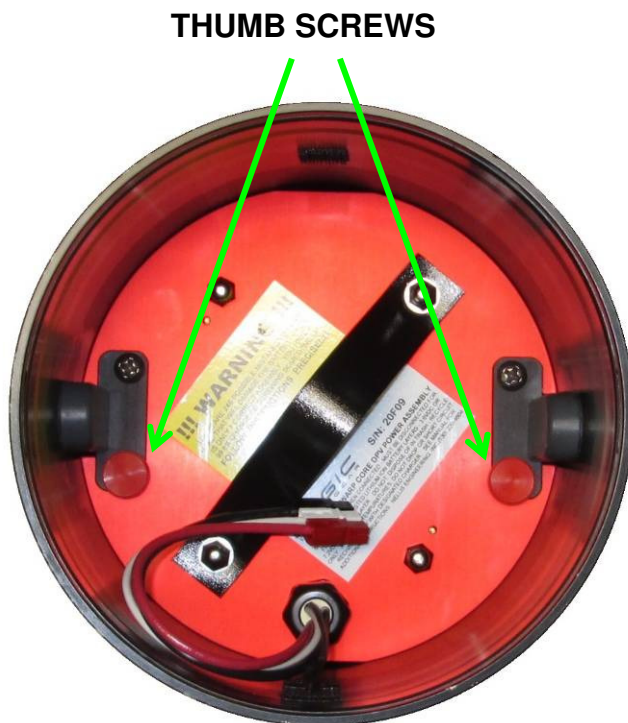


Figure 1

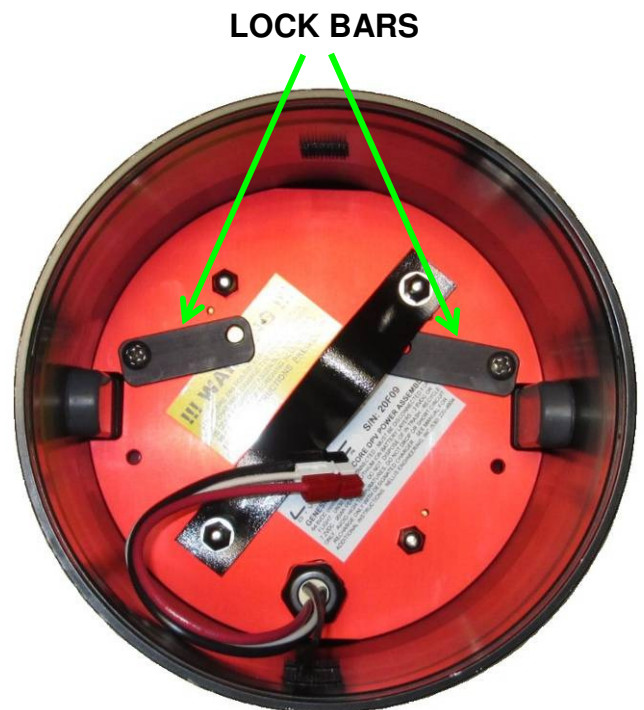


Figure 2

2. Pull up on battery using black strap handle until the red plate is 3 to 4 inches above tube opening.
3. Ensure cable from nose of DPV is disconnected before removing battery completely from DPV. (Figure 3) The connector has a small latch that must be actuated to disconnect.

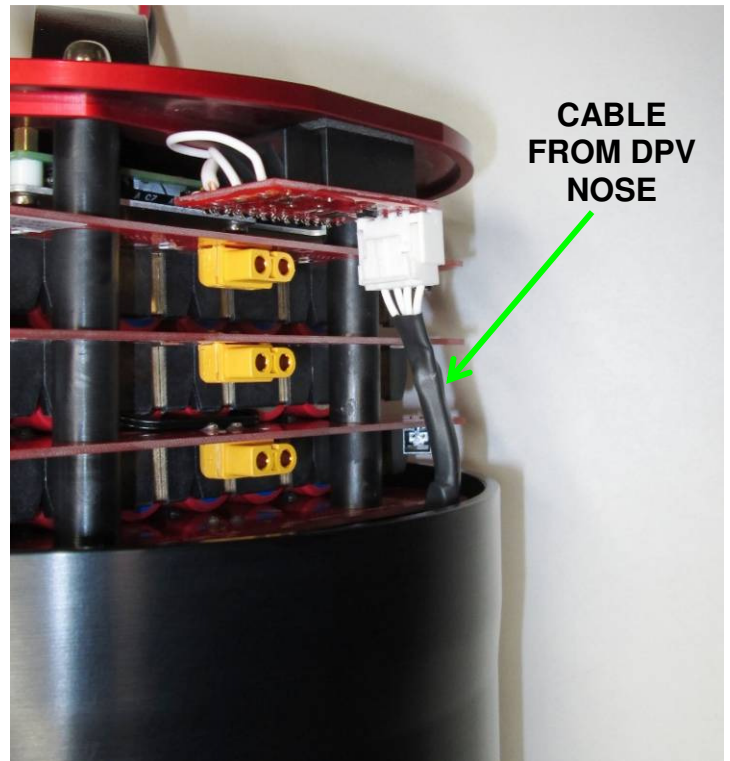


Figure 3

4. Place battery with the red aluminum mounting plate down on a stable support base to raise it up for wire clearance, before beginning to work on the battery. (Figure 4)

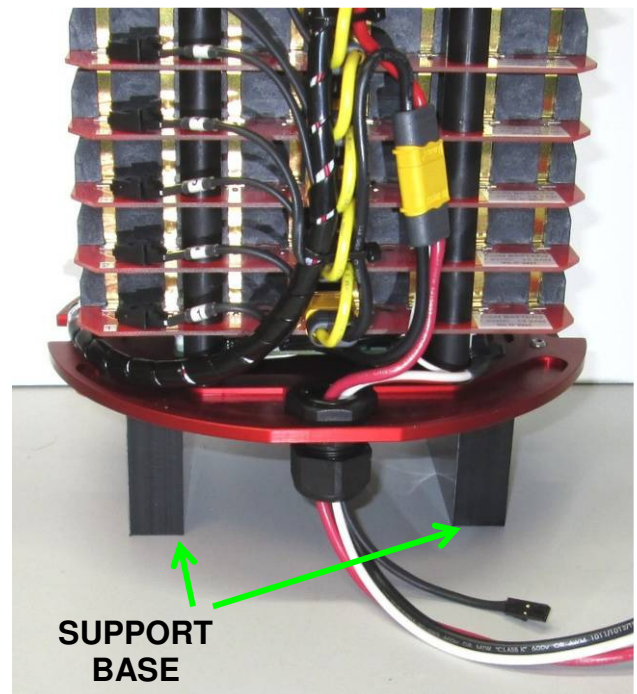


Figure 4

Assembly After Travel or Shipping - Genesis 2.1 (9 layer battery)

1. Locate the Genesis 2.1 yellow wiring harness (Figure 5) and connect to the BATTERY LAYERS ONLY as shown in Figure 6, starting from the bottom layer with the black wire and working up.



Figure 5 – Genesis 2.1 Wiring harnesses

2. Plug the remaining female connector into the mating connector from the red aluminum plate.

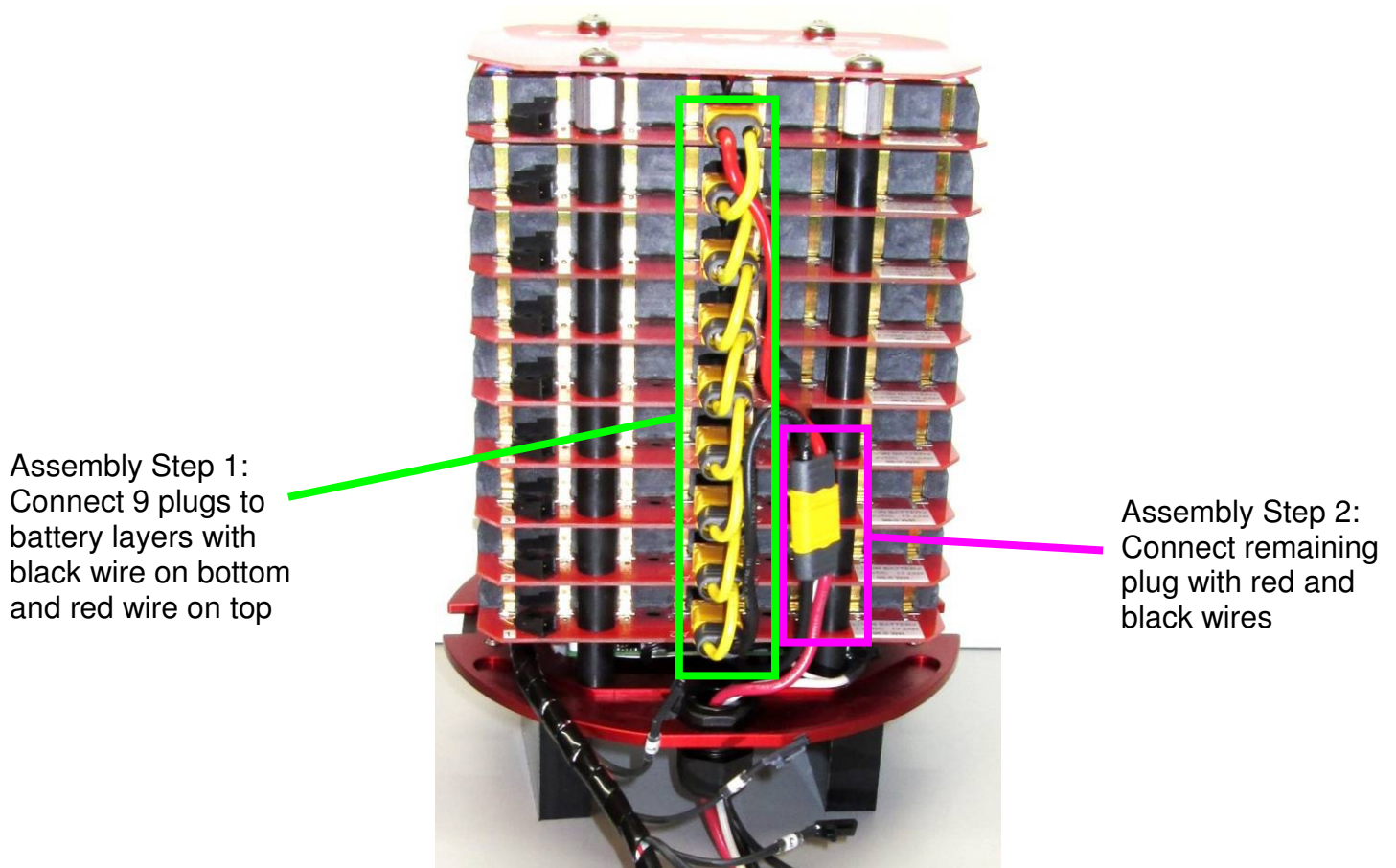


Figure 6

3. Locate the 9 small black connector housings, one on each red circuit board layer, and verify that the pins are properly aligned in the housing and not bent. If pins are bent, **DO NOT USE A METAL TOOL TO STRAIGHTEN THEM!** Starting with the small black connector labeled **1** on the 2.1 black wire harness (cell voltage sensing), carefully install the small black connectors, **IN NUMERICAL ORDER – 1,2,3,4,5,6,7,8,9** into the mating connector with the same number. (Figure 7) #1 should be on the bottom and #9 should be on the top as shown.



Figure 7

4. Verify battery operation with Bluetooth app on phone. Ensure that the voltage for each set of 18 cells is being read and that the voltages are close to the same. They should be between 3.00V and 4.15V, and within approximately .030 volts of each other. (Figure 8) If voltages are not correct, disconnect the small black connectors in **REVERSE NUMERICAL ORDER - 9,8,7,6,5,4,3,2,1**. A small latch on each connector must be pressed to remove connector. Check voltages as you disconnect to attempt to isolate a connector that may have not been properly aligned when connected.

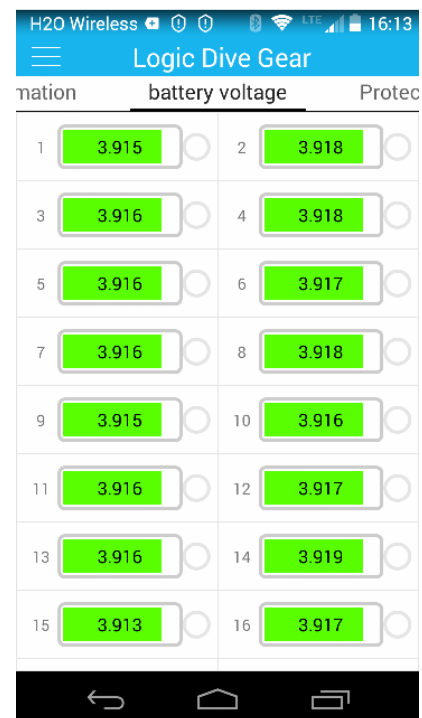


Figure 8

5. Secure the wire harnesses with cable ties in two places, with the tie loop behind the yellow wire harness, as shown in (Figure 9)



Figure 9

6. The connectors on the opposite side of the battery are not used on the 2.1 battery. (Figure 10)
7. Lower the battery into the DPV body with the cable from the nose of the DPV body on the side of the battery with the Charge Control Circuit Board (CCCB). Stop 3 to 4 inches before the tube opening and connect the cable to the white 4 pin connector (Figure 3). Rotate the 2 black locking bars clear of the notches in the red aluminum plate (Figure 2) and finish lowering the battery into the DPV body so the gray bars align with the notches in the red plate of the battery. Rotate the black lock bars into the slot in the gray bars to lock the battery in place and install the two red thumb screws finger tight. (Figure 1)

**CHARGE CONTROL
CIRCUIT BOARD**



Figure 10

Disassembly for travel or shipping – Genesis 2.1 (9 layer battery)

1. Remove the Warp Core battery assembly from DPV body using the **Removing Battery from DPV Body** procedure above.
2. Remove the 9 small black connectors from the battery layers (Figure 7) in **REVERSE NUMERICAL ORDER - 9,8,7,6,5,4,3,2,1**. A small latch on each connector must be pressed to remove each connector.
3. Remove the single yellow connector with red and black wires (Figure 6 – pink outline)
4. Remove the 9 yellow connectors from the battery layers (Figure 6 – green outline)
5. Reinstall the Warp Core Battery assembly into the DPV body without the yellow wire harness and without connecting the cable from the nose of the DPV. Do not remove the opposite end of the black wire harness from the BMS, let the wire harness hang loosely in the body and ensure the black wire harness does not get pinched.
6. Secure the Warp Core Battery in the DPV body with the black lock bars and red thumb screws.
7. Store the yellow wire harness someplace safe until arrival at destination.

Note

Lithium Ion batteries are considered Dangerous Goods (DG) for commercial shipping. Special training is required by federal and international regulations, even for exempted shipments when Dangerous Goods Declarations paperwork is not required. Batteries must be discharge to less than 30% for commercial shipment. When the layers of the WARP Core Battery System are electrically disconnected and the assembly installed in the DPV body, it is UN3481 - LITHIUM ION BATTERIES CONTAINED IN EQUIPMENT, Batteries less than 100Wh, UN38.3 testing - Passed. Weight limits apply to exempted shipment. Contact the shipping company for their requirements and directions for shipping lithium batteries, as regulations are subject to change.

Shipping and Travel assembly for Genesis 2.2 and SW (18 layer)

1. Locate the Genesis 2.2 and SW wiring harness kit (Figure 11)

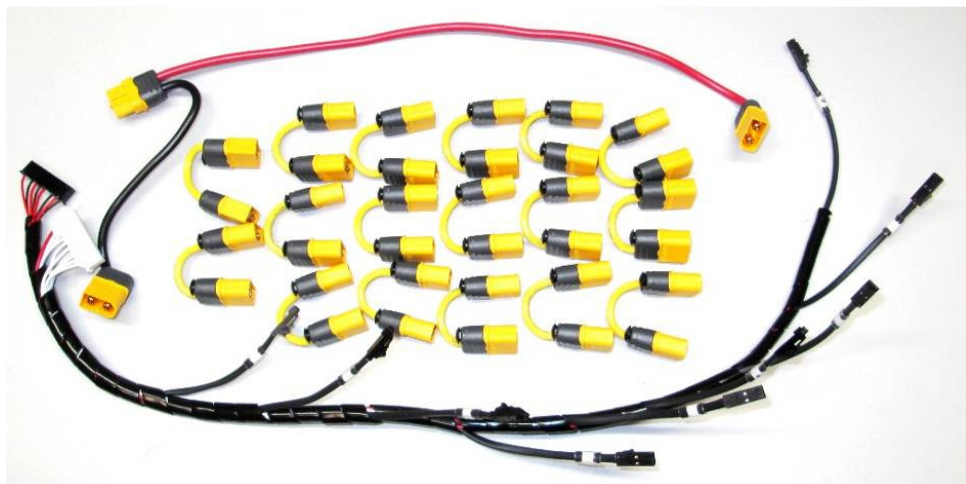


Figure 11 – Genesis 2.2 Wiring harness kit

CAUTION

Failure to install the jumpers in the correct position will result in shorting of the cells and blowing of the fuses on the battery layers.

2. Install 9 jumpers between the battery layers (Figure 12 - blue outline), starting on the very bottom layer, just above the Charge Control Circuit Board and working up.

**CHARGE CONTROL
CIRCUIT BOARD**

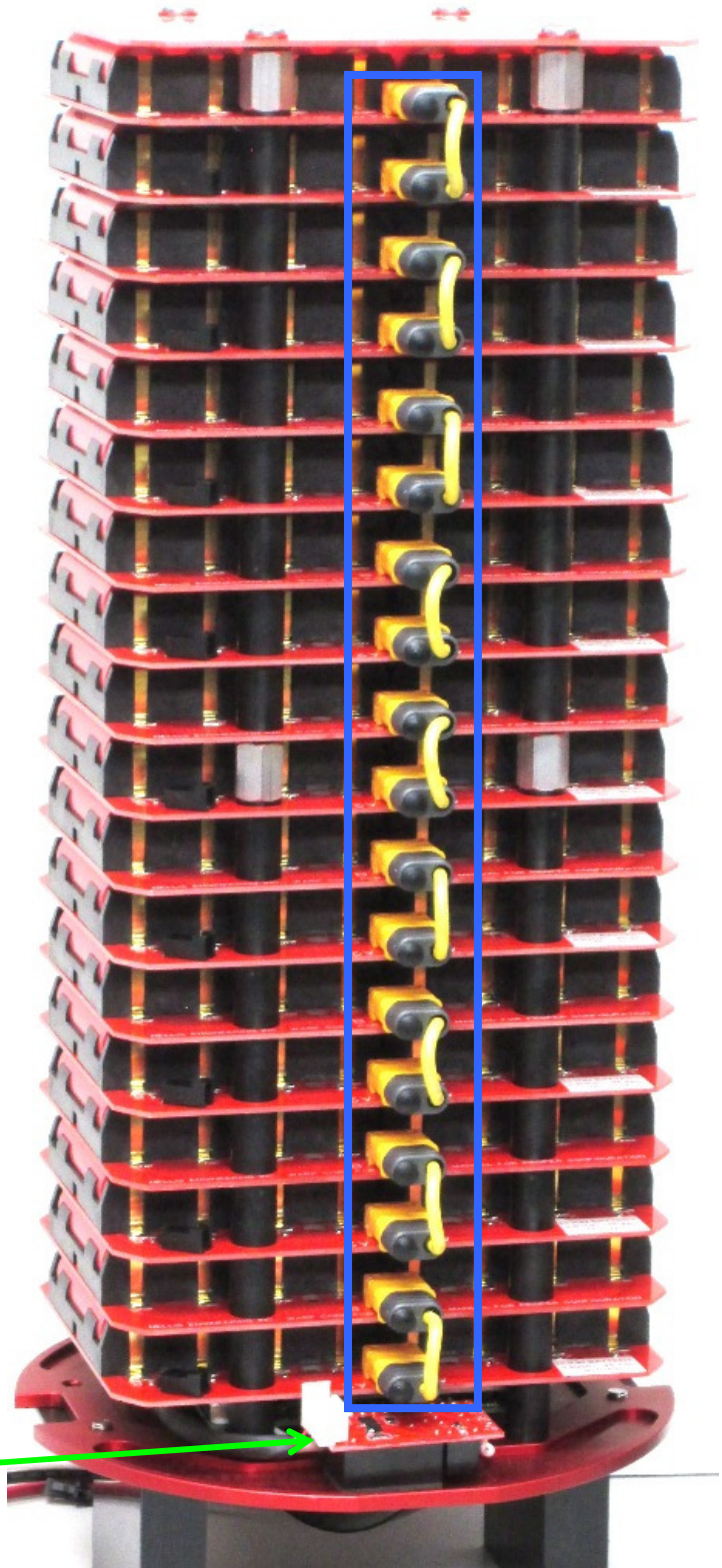


Figure 12

3. Connect the yellow connector with the single black wire to the very bottom layer and the yellow connector with the single red wire to the very top layer (Figure 13 – green outlines) DO NOT connect other end of harness yet.
4. Connect the 8 jumpers between the layers as shown (Figure 13 – blue outline) starting on the 2nd layer with the #1 label and working up.
5. Connect the remaining yellow connector with the red and black wires, to the mating connector on the aluminum mounting plate. (figure 13 – pink outline)

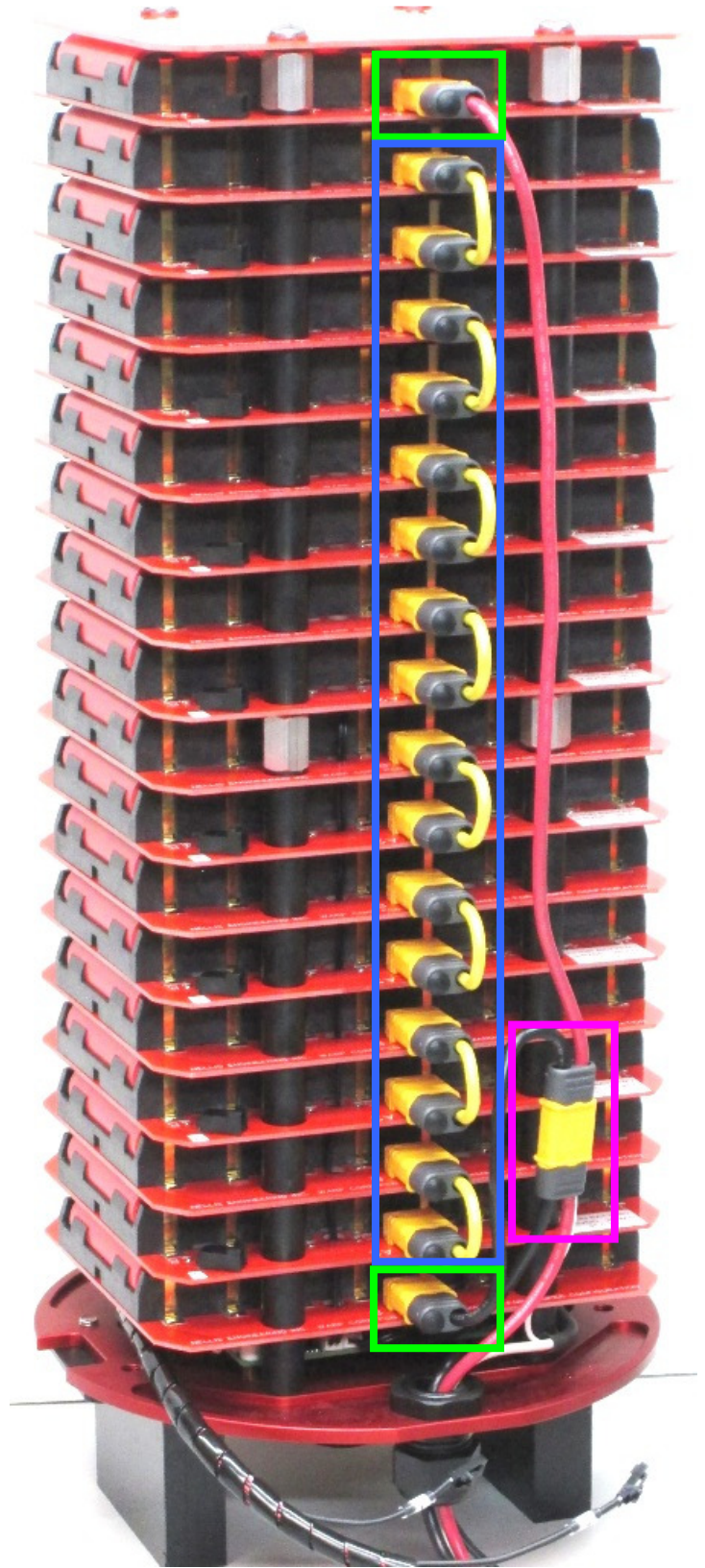


Figure 13

6. Locate the 9 small black connector housings, one on every other battery layer, and verify that the pins are properly aligned in the housing and not bent. If pins are bent, **DO NOT USE A METAL TOOL TO STRAIGHTEN THEM!** Starting with the small black connector labeled **1** on the 2.2 black wire harness (cell voltage sensing), carefully install the small black connectors, **IN NUMERICAL ORDER – 1,2,3,4,5,6,7,8,9** into the mating connector with the same number. (Figure 14 – green outline) #1 should be on the second layer from bottom and #9 should be on the top as shown, skipping layers between connectors.

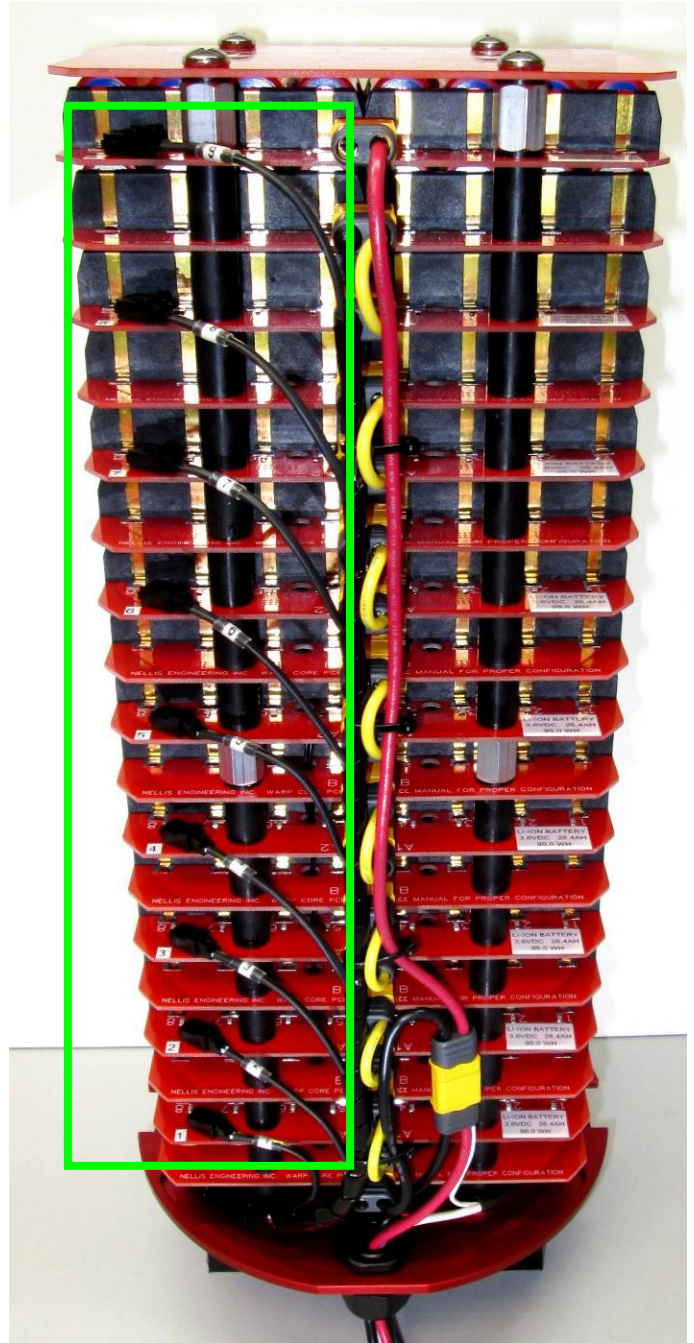


Figure 14

7. Verify battery operation with Bluetooth app on phone. Ensure that the voltage for each set of 18 cells is being read and that the voltages are close to the same. They should be between 3.00V and 4.15V, and within approximately .030 volts of each other. (Figure 15) If voltages are not correct, disconnect the small black connectors in **REVERSE NUMERICAL ORDER - 9,8,7,6,5,4,3,2,1** Check voltages as you disconnect to attempt to isolate a connector that may have not been properly aligned when connected.

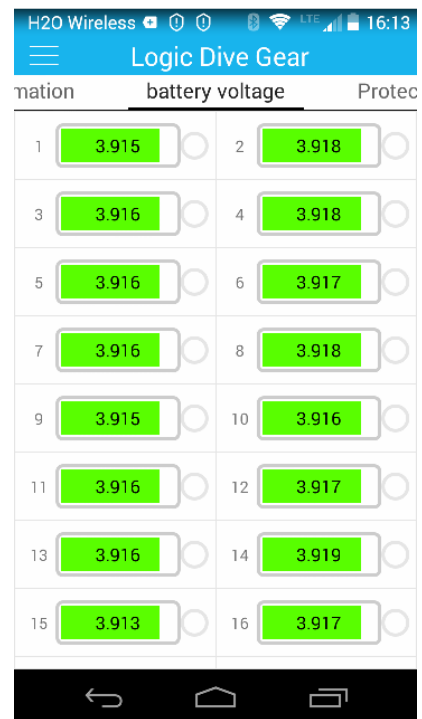


Figure 15

8. Secure the wire harnesses with cable ties in four places, with the tie loop behind the yellow wire harness, as shown in (Figure 16)

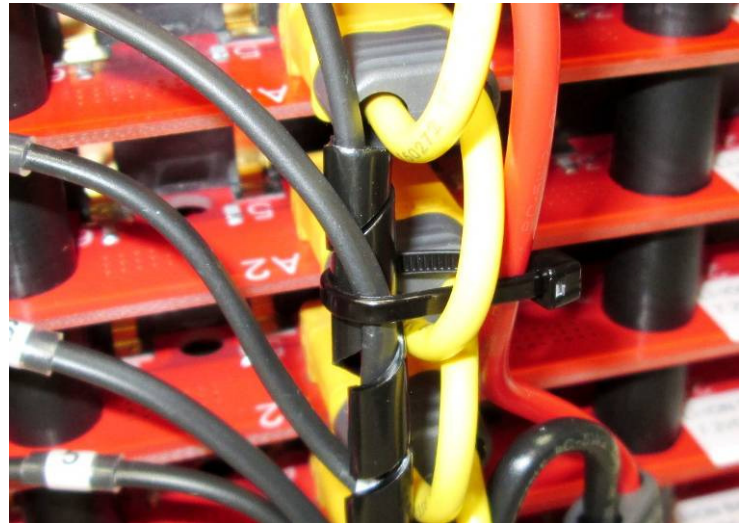


Figure 16

9. Lower the battery into the DPV body with the cable from the nose of the DPV body on the side of the battery with the Charge Control circuit board. Stop 3 to 4 inches before the tube opening and connect the cable to the white 4 pin connector (Figure 3). Rotate the 2 black locking bars clear of the notches in the red aluminum plate (Figure 2) and finish lowering the battery into the DPV body so the gray bars align with the notches in the red plate of the battery. Rotate the black lock bars into the slot in the gray bars to lock the battery in place and install the two red thumb screws finger tight. (Figure 1)

Disassembly for travel or shipping – Genesis 2.2 and SW (18 layer)

1. Remove the Warp Core battery assembly from DPV body using the **Removing Battery from DPV Body** procedure above.
2. Remove the 9 small black connectors from the battery layers (Figure 14) in **REVERSE NUMERICAL ORDER - 9,8,7,6,5,4,3,2,1** A small latch on each connector must be pressed to remove each connector.
3. Remove the single yellow connector with red and black wires (Figure 13 – pink outline)
4. Remove the 17 yellow jumpers from the both sides of the battery layers (Figures 12 and 13 – blue outline)
5. Reinstall the Warp Core Battery assembly into the DPV body without the yellow wire harness pieces and without connecting the cable from the nose of the DPV. Do not remove the opposite end of the black wire harness from the BMS, let the wire harness hang loosely in the body and ensure the black wire harness does not get pinched.
6. Secure the Warp Core Battery in the DPV body with the black lock bars and red thumb screws.
7. Store the yellow wire harness pieces someplace safe until arrival at destination.

Note

Lithium Ion batteries are considered Dangerous Goods (DG) for commercial shipping. Special training is required by federal and international regulations, even for exempted shipments when Dangerous Goods Declarations paperwork is not required. Batteries must be discharge to less than 30% for commercial shipment. When the layers of the WARP Core Battery system are electrically disconnected and the assembly installed in the DPV body, it is UN3481 - LITHIUM ION BATTERIES CONTAINED IN EQUIPMENT, Batteries less than 100Wh, UN38.3 testing - Passed. Weight limits apply to exempted shipment. Contact the shipping company for their requirements and directions for shipping lithium batteries, as regulations are subject to change.

Cell Replacement – Genesis 2.1 (9 layer battery)

1. Remove the Warp Core battery assembly from DPV body using the **Removing Battery from DPV Body** procedure above.
2. Disconnect the Warp Core battery using the **Disassembly for travel or shipping – Genesis 2.1 (9 layer battery)** procedure above.
3. Remove 4 screws, using a #3 Phillips screw driver from top cover plate of Warp Core assembly. (Figure 17) Place cover plate, 4 screws and 4 black plastic washers from beneath the cover plate, out of the way until needed for assembly.



Figure 17

4. Remove 4 threaded hex spacers from top battery layer and 4 black plastic washers (Figure 18) Place out of the way until needed for assembly.
5. Lift the battery layer up and off of the 4 threaded rods. Place someplace safe and non-conductive.
6. Remove the 4 tall black plastic spacers and the next battery layer. Place someplace safe and non-conductive. Temperature sensors are attached to the cells on certain layers. Remove tape and allow the sensor wires to slide out of holes in battery layer circuit boards while removing.
7. Continue removing all 9 battery layers from the threaded rods.

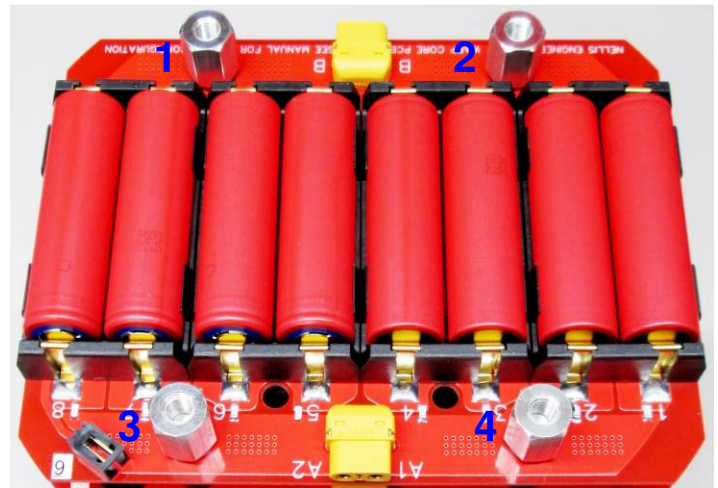


Figure 18

8. You should notice that one end of the cell has a slight indentation around the circumference and a blue ring on the end. (Figure 19) That is the Positive + end. Remove all the cells from each layer by lifting up on the positive end, since it is easier to remove that way. On the 9 layer battery, cells 1-4 are oriented in one direction and cells 5-8 are the opposite direction. Store the old cells somewhere safe and out of the way, before beginning to install new cells.



Figure 19

9. **USE ONLY BRAND NEW PANASONIC/SANYO NCR18650GA CELLS FROM THE SAME PRODUCTION RUN AND TEST THE VOLTAGE OF EVERY SINGLE CELL** before installing into the battery layers. All cell voltages should be within 5mV of each other and are usually between 3.48 to 3.51VDC. Cells that are not within 10mV of the average voltage, either higher or lower, should not be used in the DPV. Any cell that has been dropped on a hard surface and dented should not be used either. It is a good idea to always order a couple extra cells

CAUTION

Failure to install cells in proper orientation will result in blown fuses and possible damage to cells.

10. Install cells into the battery layer cell holders as shown in Figure 20, one cell at a time and negative end in first. Install cells in all 9 layers before assembling into the Warp Core stack.

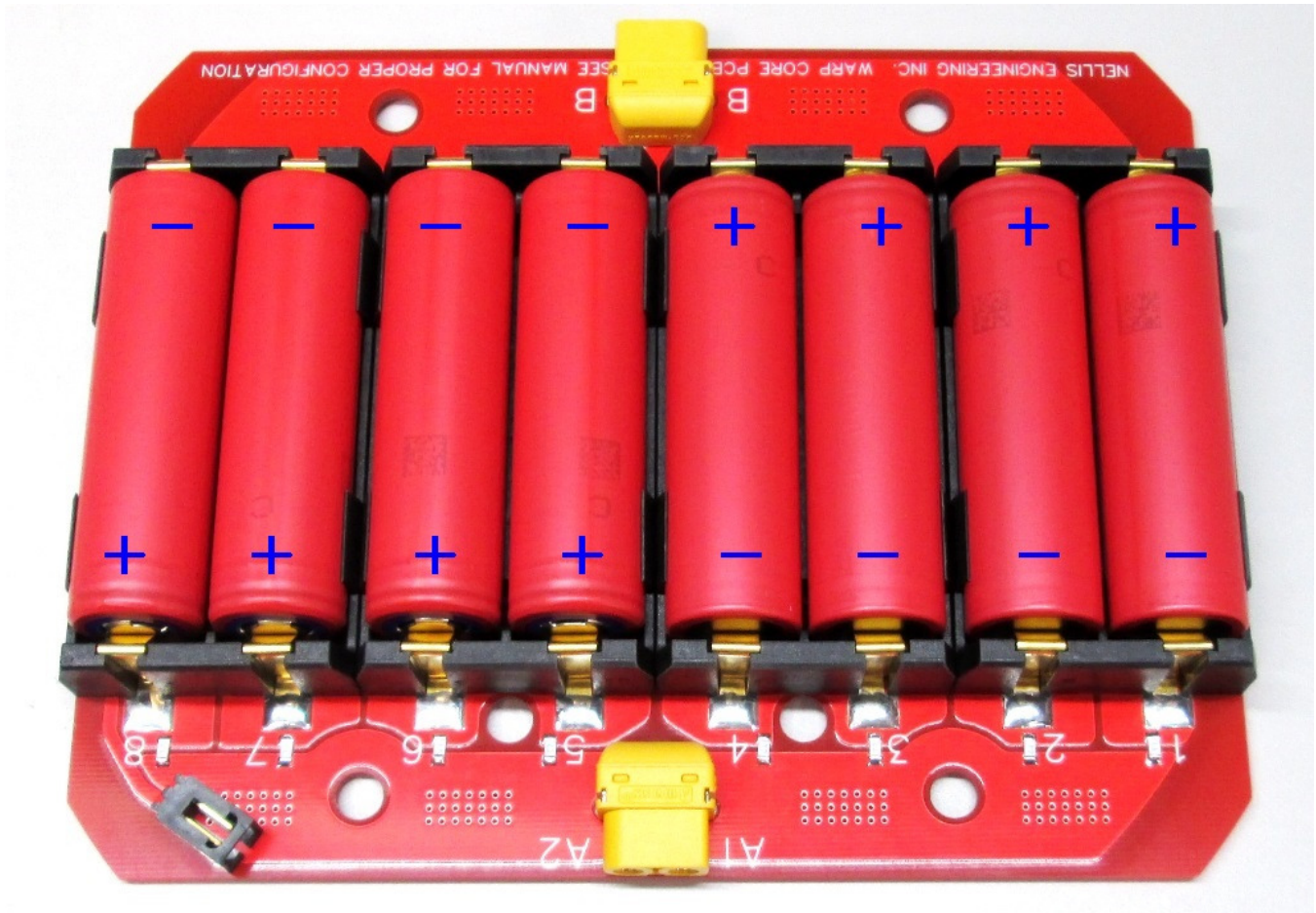


Figure 20 – 9 Layer cell orientation for Genesis 2.1

11. **Go back and double check that all cells are installed with the correct polarity orientation!!!**

12. The layers are numbered 1 through 9 with a label next to the small black 2 pin connector. Ensure 4 black plastic 3/4" (19mm) tall spacers are installed on the threaded rods contacting the red aluminum mounting plate and then install layer #1 onto the threaded rod with the **B - B** printed on the circuit board towards the Charge Control Circuit Board. Stop about half way down and feed the temperature sensors through the holes as shown in Figure 21 before lowering it all the way to the bottom.
13. Install 4 black plastic 3/4" spacers (one on each threaded rod) and then install layer #2, also passing the temperature sensors through the holes in the layer.

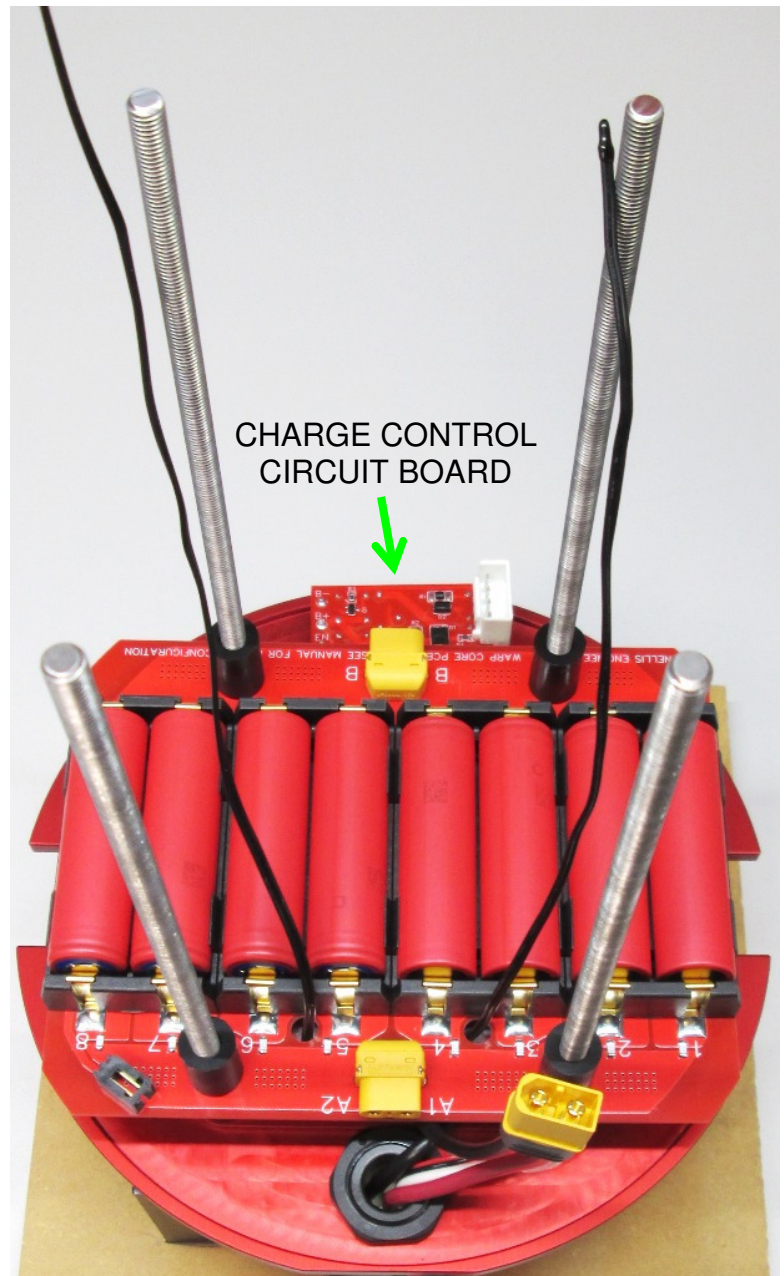


Figure 21

14. Repeat step 12 for layer #3. Secure the left temperature sensor wire to the cells on layer #3 as shown in Figure 22, using tape. The tip of the sensor should be in contact with the cells.



Figure 22

15. Repeat Step 12 for layers 4, 5 and 6. Secure the right temperature sensor wire to the cells on layer #6 as shown in Figure 23, using tape. The tip of the sensor should be in contact with the cells.
16. Install 4 black plastic 3/4" spacers again and then install layer #7. Repeat for layers 8 and 9.



Figure 23

17. Confirm the layers are in sequential order from #1 on the bottom to #9 on top and that the black plastic spacers are installed between each layer, then install 4 black plastic 1/16" (1.6mm) thick washers, one on each threaded rod as shown in Figure 24.



Figure 24

18. Thread a 5/8" (16mm) long threaded hex spacers on each threaded rod until just finger snug. (Figure 25) Tighten each threaded spacer an additional 1/2 turn.



Figure 25

19. Place 4 black plastic 1/16" (1.6mm) thick washers, one on each threaded spacer as shown in Figure 26.

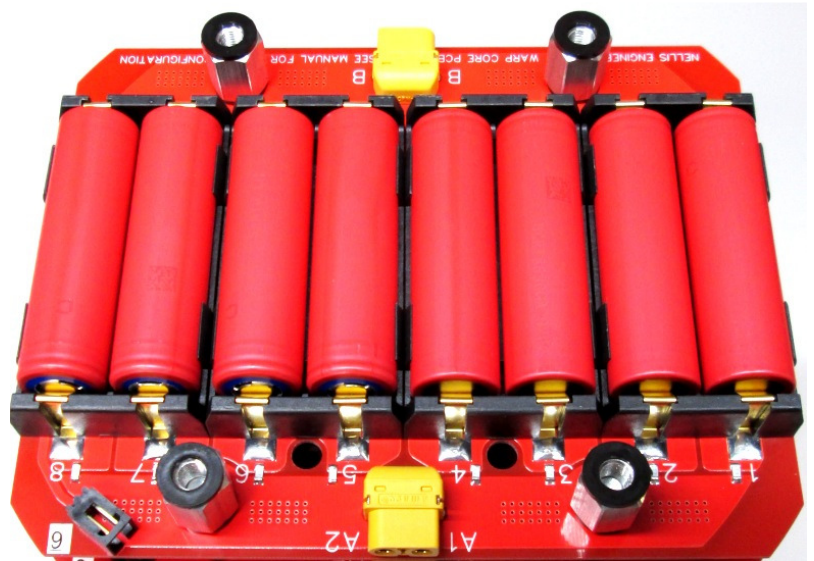


Figure 26

20. Carefully place the Warp Core end plate onto the washers, so that the holes align and then install 4 each 1/4-28 x3/8" screws with a #3 Phillips screwdriver. (Figure 27)

NOTE

The Warp Core end plate is different between the 9 layer and 18 layer battery assemblies. Do not interchange the two when converting from one to the other.

21. Complete the assembly using **Assembly After Travel or Shipping - Genesis 2.1 (9 layer battery)** procedure above.



Figure 27

Cell Replacement – Genesis 2.2 and SW (18 layer battery)

1. Remove the Warp Core battery assembly from DPV body using the **Removing Battery from DPV Body** procedure above.
2. Disconnect the Warp Core battery using the **Disassembly for travel or shipping – Genesis 2.2 and SW (18 layer)** procedure above.
3. Remove 4 screws, using a #3 Phillips screw driver from top cover plate of Warp Core assembly. (Figure 28) Place cover plate, 4 screws and 4 black plastic washers from beneath the cover plate, out of the way until needed for assembly.



Figure 28

4. Remove 4 threaded aluminum hex spacers from top battery layer and 4 black plastic washers (Figure 29) Place out of the way until needed for assembly.
5. Lift the battery layer up and off of the 4 threaded rods. Place someplace safe and non-conductive.
6. Remove the 4 tall black plastic spacers and the next battery layer. Place someplace safe and non-conductive.
7. Continue removing the top 9 battery layers from the threaded rods.
8. Remove the 4 threaded rods and 4 each 1/16" thick black plastic washers. Place out of the way until needed for assembly.

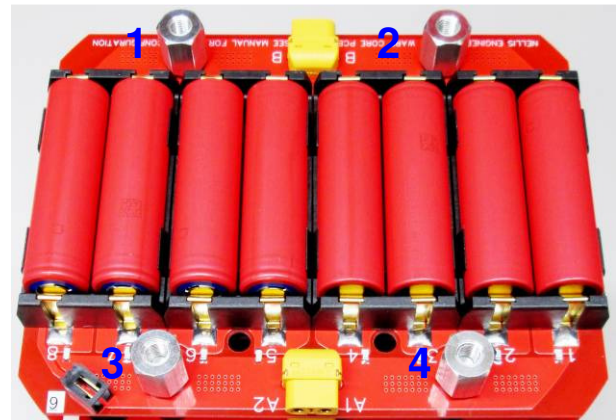


Figure 29

9. Repeat steps 4 through 7 of this procedure with the bottom 9 layers. Remove tape and allow the sensor wires to slide out of holes in battery layer circuit boards while removing.
10. You should notice that one end of the cell has a slight indentation around the circumference and a blue ring on the end. (Figure 30) That is the Positive + end. Remove all the cells from each layer by lifting up on the positive end, since it is easier to remove that way. On the 9 layer battery, cells 1-4 are oriented in one direction and cells 5-8 are the opposite direction. Store the old cells somewhere safe and out of the way, before beginning to install new cells.

11. **USE ONLY BRAND NEW PANASONIC/SANYO NCR18650GA CELLS FROM THE SAME PRODUCTION RUN AND TEST THE VOLTAGE OF EVERY SINGLE CELL** before installing into the battery layers. All cell voltages should be within 5mV of each other and are usually between 3.48 to 3.51VDC. Cells that are not within 10mV of the average voltage, either higher or lower, should not be used in the DPV. Any cell that has been dropped on a hard surface and dented should not be used either. It is a good idea to always order a couple extra cells



Figure 30

CAUTION

Failure to install cells in proper orientation will result in blown fuses and possible damage to cells.

12. Install cells into the battery layer cell holders as shown in Figure 20, one cell at a time and negative end in first. Install cells in all 18 layers before assembling into the Warp Core stack.

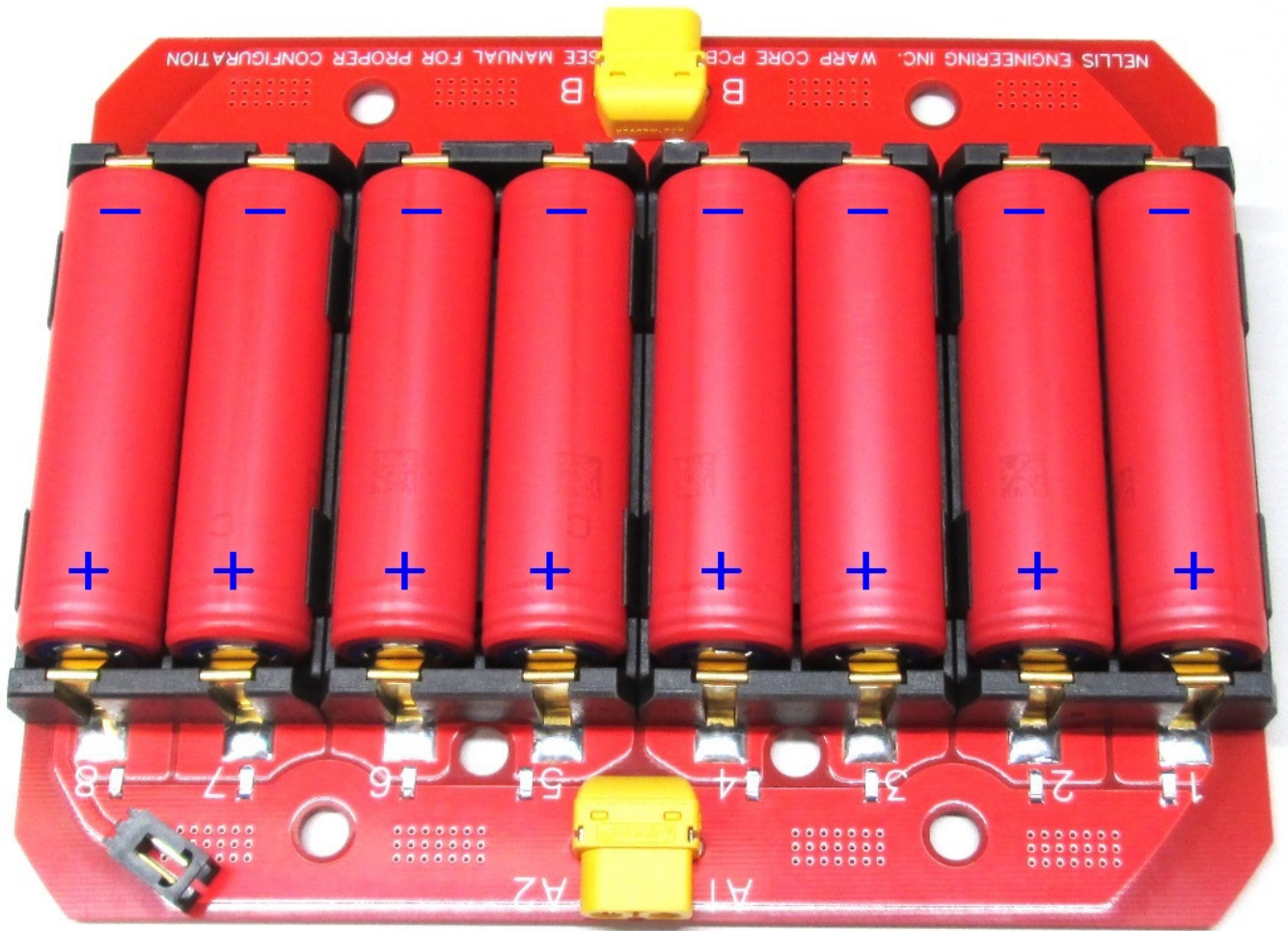


Figure 31 – 18 Layer cell orientation for Genesis 2.2

13. **Go back and double check that all cells are installed with the correct polarity orientation!!!**

14. 9 of the 18 layers are numbered 1 through 9 with a label next to the small black 2 pin connector. The other 9 layers are unnumbered. Ensure 4 black plastic 3/4" (19mm) tall spacers are installed on the threaded rods contacting the red aluminum mounting plate and then install an UNNUMBERED layer onto the threaded rods first with the **A1 - A2** printed on the circuit board towards the Charge Control Circuit Board. Stop about half way down and feed the temperature sensors through the holes as shown in Figure 32 before lowering it all the way to the bottom.

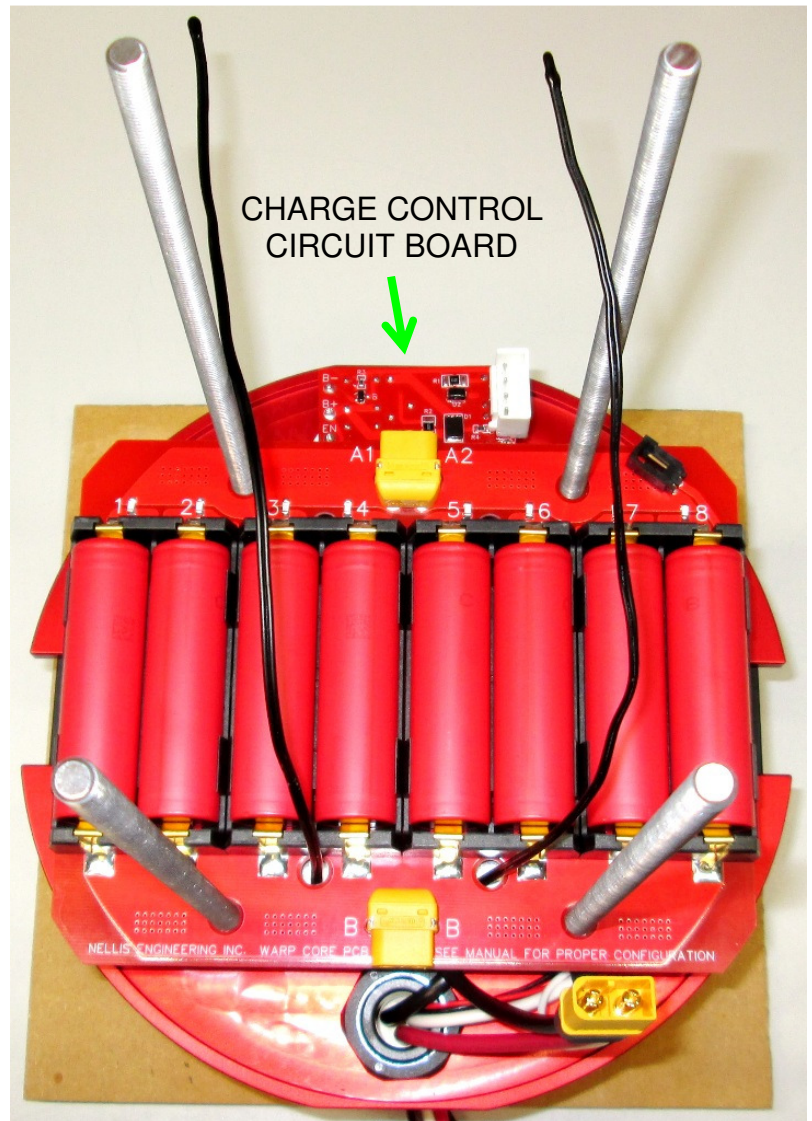


Figure 32

15. Install 4 black plastic 3/4" spacers (one on each threaded rod) and then install layer #1 with the **B – B** printed on the circuit board towards the Charge Control Circuit Board, also passing the temperature sensors through the holes in the layer. Secure the right temperature sensor wire to the cells on layer #1 as shown in Figure 33, using tape. The tip of the sensor should be in contact with the cells.

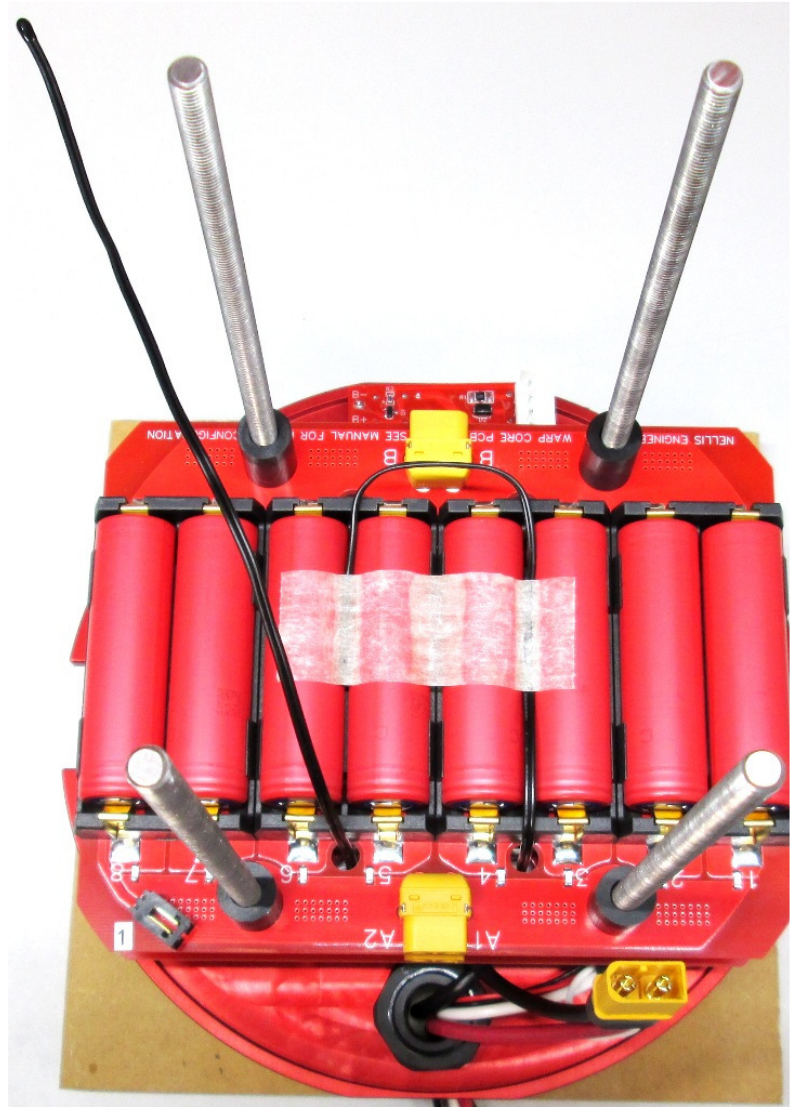


Figure 33

16. Repeat steps 14 and 15 for the next 7 layers, alternating unnumbered boards with the **A1 – A2** towards the Charge Control Circuit Board (CCCB) and numbered boards increasing sequentially with **B – B** towards the Charge Control Circuit Board. Secure the left temperature sensor wire to the cells on the ninth layer, which is unnumbered, as shown in Figure 34, using tape. The tip of the sensor should be in contact with the cells.

BLACK PLASTIC WASHERS
UNDER THREADED HEX SPACER



Figure 34

17. **Confirm the layers are in correct order:**

Bottom layer, unnumbered, A1 – A2 towards CCCB

2nd layer, #1, B – B towards CCCB, Right Temp sensor

3rd layer, unnumbered, A1 – A2 towards CCCB

4th layer, #2, B – B towards CCCB

5th layer, unnumbered, A1 – A2 towards CCCB

6th layer, #3, B – B towards CCCB

7th layer, unnumbered, A1 – A2 towards CCCB

8th layer, #4, B – B towards CCCB

9th layer, unnumbered, A1 – A2 towards CCCB, Left Temp sensor

18. Install 4 black plastic 1/16" (1.6mm) thick washers, one on each threaded rod **before** threading on the 5/8" (16mm) long threaded hex spacers on each threaded rod until just finger snug. (Figure 34) Tighten each threaded spacer an additional 1/2 turn.

19. Install the four threaded rods removed earlier, into the threaded hex spacers, finger snug and then install 4 black plastic 1/16" (1.6mm) thick washers, one on each threaded rod as shown in Figure 35.
20. Install layer labeled #5 onto the threaded rods with the **B – B** printed on the circuit board towards the Charge Control Circuit Board and install 4 black plastic 3/4" spacers.
21. Repeat steps 14 and 15 for the remaining 8 layers, alternating unnumbered boards with the **A1 – A2** towards the Charge Control Circuit Board (CCCB) and numbered boards increasing sequentially with **B – B** towards the charge control circuit board.



Figure 35

22. **Confirm the layers are in correct order:**

- 10th layer, #5, B – B towards CCCB
- 11th layer, unnumbered, A1 – A2 towards CCCB
- 12th layer, #6, B – B towards CCCB
- 13th layer, unnumbered, A1 – A2 towards CCCB
- 14th layer, #7, B – B towards CCCB
- 15th layer, unnumbered, A1 – A2 towards CCCB
- 16th layer, #8, B – B towards CCCB
- 17th Seventh layer, unnumbered, A1 – A2 towards CCCB
- 18th layer, #9, B – B towards CCCB



Figure 36

23. Install 4 black plastic 1/16" (1.6mm) thick washers, one on each threaded rod (Figure 36) **before** threading on the 5/8" (16mm) long threaded hex spacers on each threaded rod until just finger snug. (Figure 37) Tighten each threaded spacer an additional 1/2 turn

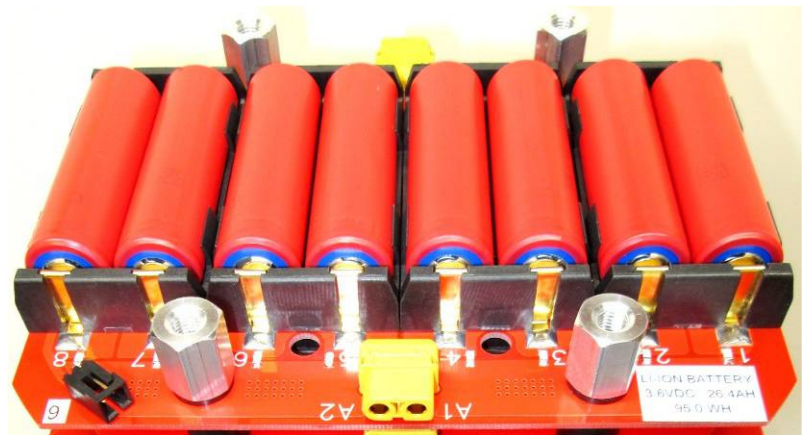


Figure 37

24. Place 4 black plastic 1/16" (1.6mm) thick washers, one on each threaded spacer, as shown in Figure 38.

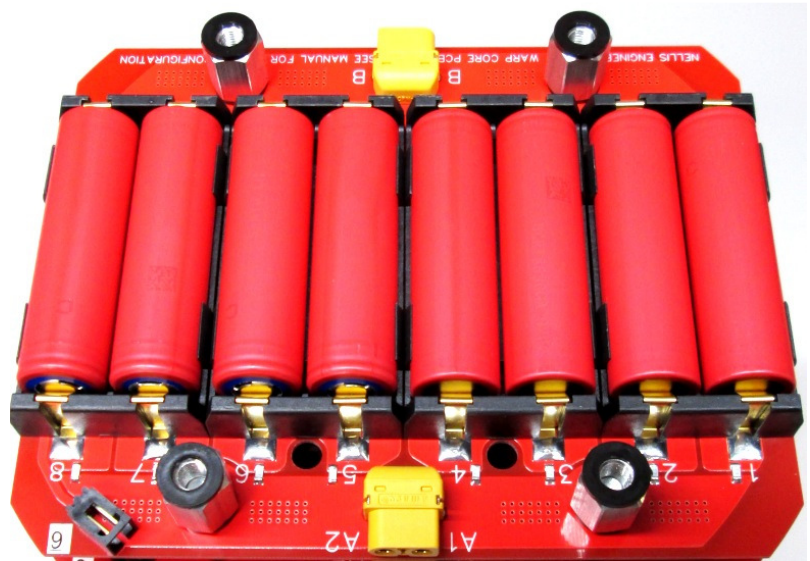


Figure 38

25. Carefully place the Warp Core end plate onto the washers, so that the holes align and then install 4 each 1/4-28 x 3/8" screws with a #3 Phillips screwdriver. (Figure 39)

NOTE

The Warp Core end plate is different between the 9 layer and 18 layer battery assemblies. Do not interchange the two when converting from one to the other.



Figure 39

26. Complete the assembly using **Assembly After Travel or Shipping - Genesis 2.2 and SW (18 layer battery)** procedure above.