Table of Contents

LiPo Discharger / Disposer (LDD)

With very few options currently available on the market to safely discharge LiPo batteries I decided to design and build something myself. I had previously used a 50-watt 12-volt halogen lamp fixture for my 3S and 4S batteries, but I quickly realized that this single lamp would not work very well with the new 6S batteries that I had just added to my fleet. I could have simply made a new halogen lamp discharge fixture by placing two 12-volt lamps in series to match the 6S battery output voltage, but I decided against that because the light and heat that the halogen lamps produce is very difficult to shield and disperse. Using off the shelf parts from places like Amazon and eBay I created two prototype versions of a heavy-duty LiPo discharger/disposer (LDD) with the cell range to service all the batteries I may use. With these designs I also wanted to create a safe and reliable way to quickly discharge a battery pack for testing, storage and disposal.

We all understand the importance of completely discharging our worn-out or damaged LiPo packs before placing them in the trash or recycling. The salt water submersion method I tried once and it is worse than watching paint dry. Driving a nail through the cells may be quick and make for a great YouTube video, but it quickly loses its appeal as a safe alternative. Running the battery down in the model is also a hit-and-miss proposition, not to mention the hazards associated with running a motor/prop at high RPM on the ground.

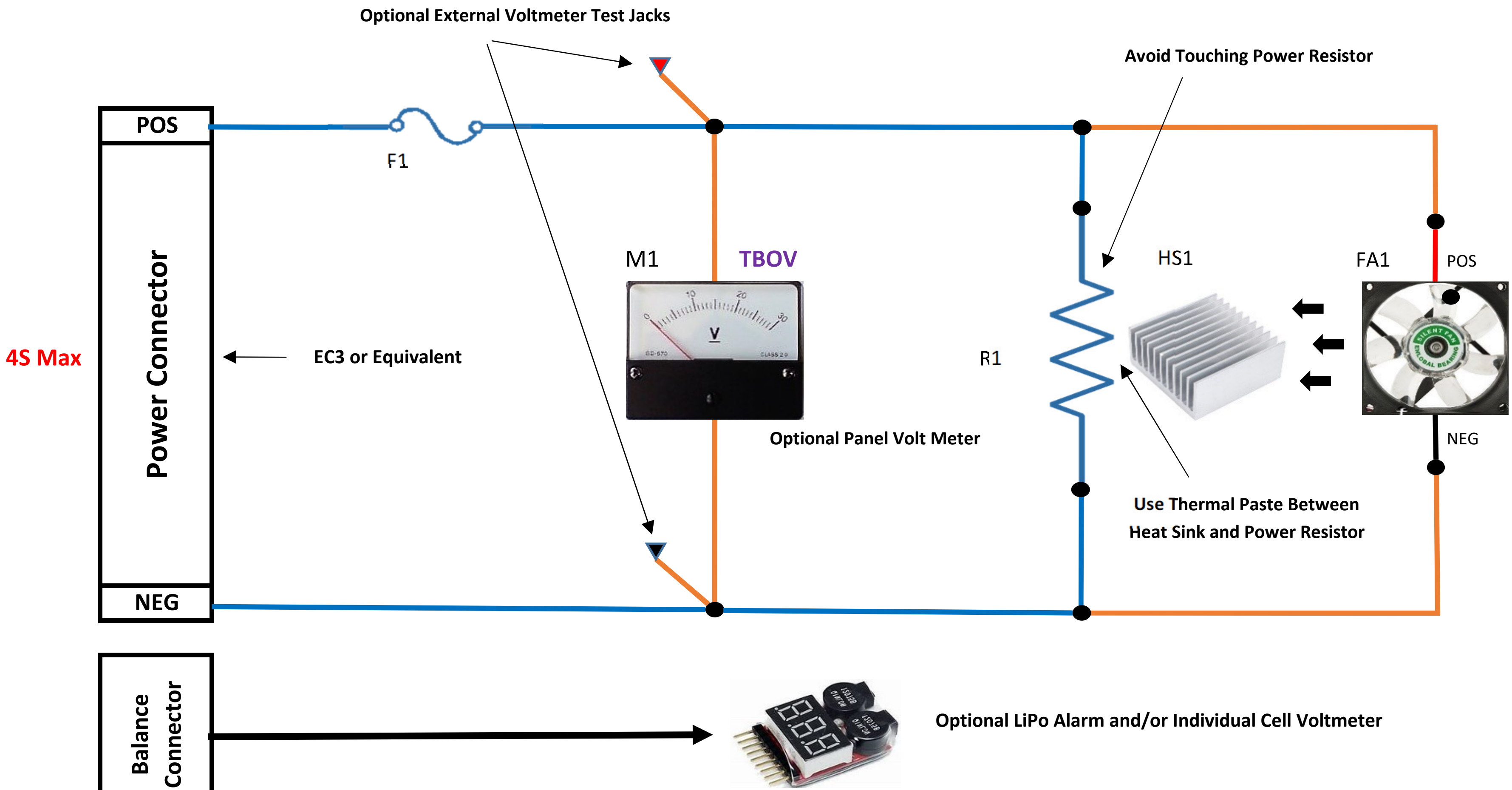
My desire was to make a compact device to fill the battery discharger/disposer role with as simple a design as possible. The average parts cost for each LDD I made was around $70, with the only difference between the two versions (V1 – V2) being the power resistor value and the addition of a second cooling fan. Not using the optional analog voltmeter, and substituting it with test jacks (for use with an external multimeter), will save you around $9 each. I really do like the visibility and functionality of the analog meters however and would recommend their use. The 12 VDC brushless low-volume cooling fans I selected are perfect for this application as they are very quiet and will operate all the way down to 3 VDC applied. Assembled around a 3” x 9” x 7/8” precut aluminum heatsink the LDD can get very warm, but not hot enough to heat the surface it is setting on or burn your fingers from unintentional contact (see the warning note in the “Instructions for Use”).

The compact wire wound power resistors I used are from a company called Uxcell (China) as I wanted to keep my costs down (around $20 each). I did find similar wire wound power resistors however at Digi-key Electronics and other US suppliers for around $45 each if you want to go that way. You could also use 200-watt open air ceramic power resistors, which are very reasonable in cost, but they are much larger than the wire wound resistors and can get very hot (no heat sink). This type of resistor should be mounted in a protective enclosure to guard against burns, and cooled with a high-volume computer case fan (instead of the low-volume fan(s)) powered from an independent 12 VDC power source.

This information is my contribution to those who enjoy this hobby as much as I do, please feel free to duplicate and share it with others. If you do decide to make an LDD from these plans let me know at s.greer@outlook.com and I will send you more information on how I assembled mine and a list of the parts & vendors I used.

Safe modeling!

Steve Greer – Blacksheep R/C Modelers

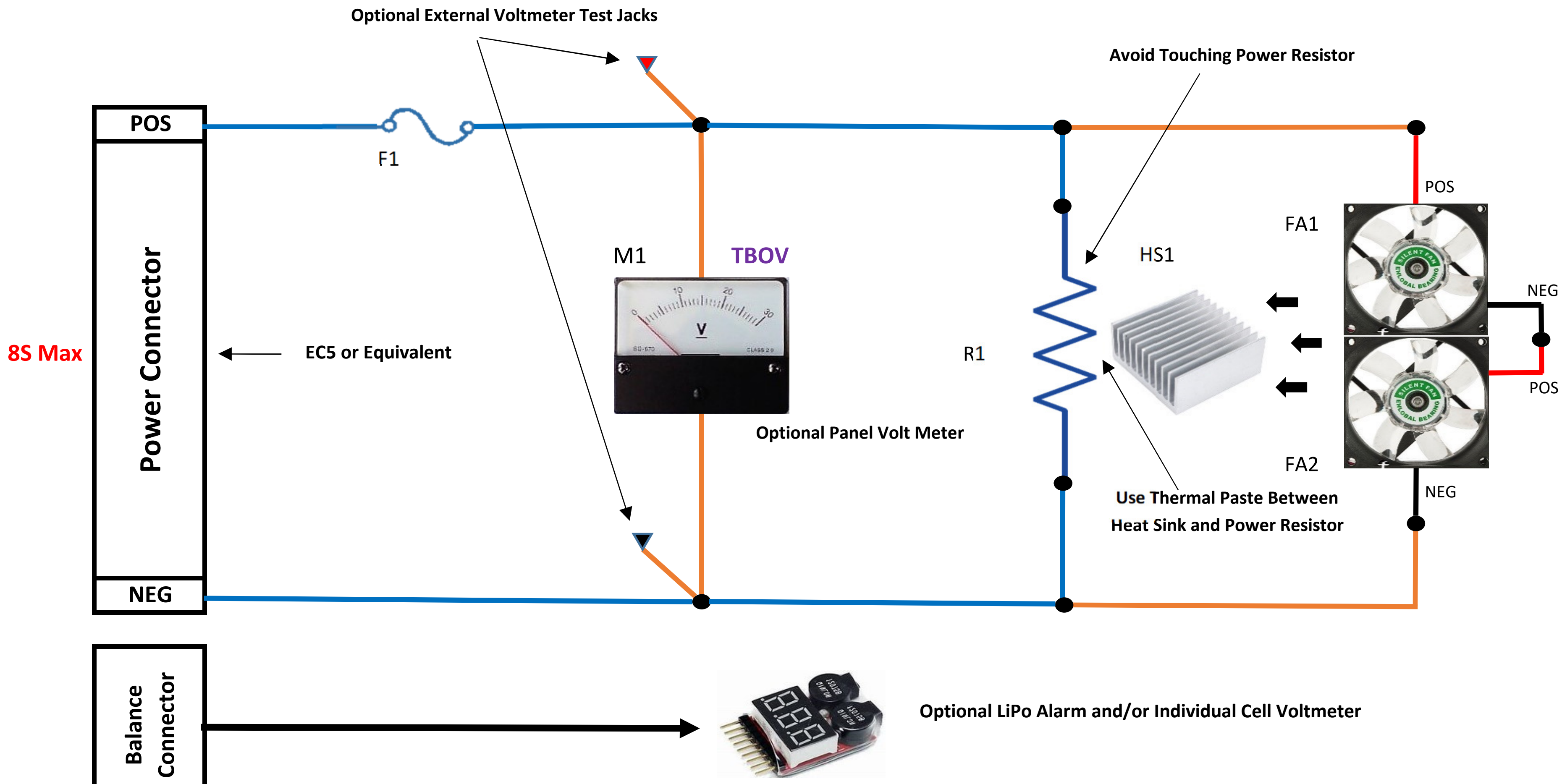


TBOV = Total Battery Output Voltage
Blue Wires - 12 AWG Silicone
Orange Wires - 22 to 26 AWG

CALCULATED LOADS WITH A 3 OHM RESISTOR			
Cells	**Volts**	**Amps**	**Watts**
1 Cell @ full charge	4*	**1.3**	5
2 Cell @ full charge	8	**2.7**	21
3 Cell @ full charge	12	**4.0**	48
4 Cell @ full charge	16	**5.0**	85

* Cooling fan may not run and is not required

1 - 4 Cell LiPo Discharger / Disposer (LDD) V1		
F1	10 Amp 12 VDC Fuse	
M1	0-30 VDC Panel Voltmeter	
R1	3 Ohm 200 Watt Power Resistor	
HS1	9.45''x3''x0.87'' Finned Aluminum Heat Sink	
FA1	12 VDC 80mm Computer Fan	
Designed and Drawn by Steve Greer		**11/06/18**



TBOV = Total Battery Output Voltage
Blue Wires - 12 AWG Silicone
Orange Wires - 22 to 26 AWG

CALCULATED LOADS WITH A 7 OHM RESISTOR			
Cells	**Volts**	**Amps**	**Watts**
5 Cell @ full charge	20	**2.9**	57
6 Cell @ full charge	24	**3.4**	82
7 Cell @ full charge	28	**4.0**	112
8 Cell @ full charge	32~	**4.6**	146

~ The 8S will peg the analog voltmeter above 30 volts, this is expected

5 - 8 Cell LiPo Discharger / DIsposer (LDD) V2	
F1	10 Amp 12 VDC Fuse
M1	0-30 VDC Panel Voltmeter
R1	7 Ohm 200 Watt Power Resistor
HS1	9.45"x3"x0.87" Finned Aluminum Heat Sink
FA1 & FA2	12 VDC 80mm Computer Fan
Designed and Drawn by Steve Greer	**11/06/18**

Instructions for Use

Discharge Load Table for the 1S-4S LDD V1

Estimated Starting Discharge Loads at 3 OHMS			
Cells	**Volts**	**Amps**	**Watts**
1 Cell @ full charge	4*	**1.3**	5
2 Cell @ full charge	8	**2.7**	21
3 Cell @ full charge	12	**4.0**	48
4 Cell @ full charge	16	**5.0**	85

* Cooling fan may not run at this voltage and is not required

Discharge Load Table for the 5S-8S LDD V2

Estimated Starting Discharge Loads at 7 OHMS			
Cells	**Volts**	**Amps**	**Watts**
5 Cell @ full charge	20	**2.9**	57
6 Cell @ full charge	24	**3.4**	82
7 Cell @ full charge	28	**4.0**	112
8 Cell @ full charge	32~	**4.6**	146

~ The analog voltmeter will peg just above 30 volts, this is normal

CAUTION!

- The following procedures are for a standard chemistry LiPo battery that has a full charge level of 4.2 volts per cell.
- Never leave the LDD unattended when it is connected to a battery. The discharge cycle is fairly quick and it will damage or destroy a battery if just one cell goes below 3.0 volts.
- The LDD power resistor case temperature will vary depending on the voltage of the battery connected. **To be safe, avoid touching the power resistor case when a battery is being discharged**.
- Always verify that the battery's discharge "C rating" is high enough to handle the above estimated discharge current.

LiPo Battery Storage/Discharge Cycle Procedures

1. Connect a LiPo alarm/cell monitor to the battery's balance connector, set the alarm to go off at 3.7 volts per cell.
2. Connect the battery to the LDD connector.
3. Monitor the discharge cycle closely, do not leave battery unattended.
4. Disconnect the battery from the LDD when the alarm sounds or when the total battery output voltage (**TBOV**) is 3.7 volts times the number of cells, for example:
    a. 1S = 3.7 volts
    b. 2S = 7.4 volts
    c. 3S = 11.1 volts
    d. 4S = 14.8 volts
    e. 5S = 18.5 volts
    f. 6S = 22.2 volts
    g. 8S = 29.6 volts
5. Let the battery rest for 5 minutes and then check all cell voltage levels to ensure they are near 3.8 volts per cell (50% charge). Reconnect the LDD if additional discharge is required, or balance charge the battery to 3.8 volts per cell if the voltages are too low.

    Note: If you use a cell monitor device that displays the battery level in a "percentage format", a word of caution. Most of these devices are not very accurate at reading a 50% charge. They are however very accurate at displaying the individual cell voltages, so always default to a 3.8 volt per cell reading as the indication of a 50% charge.

<u>LiPo Battery Condition/Capacity Check Cycle Procedures</u>

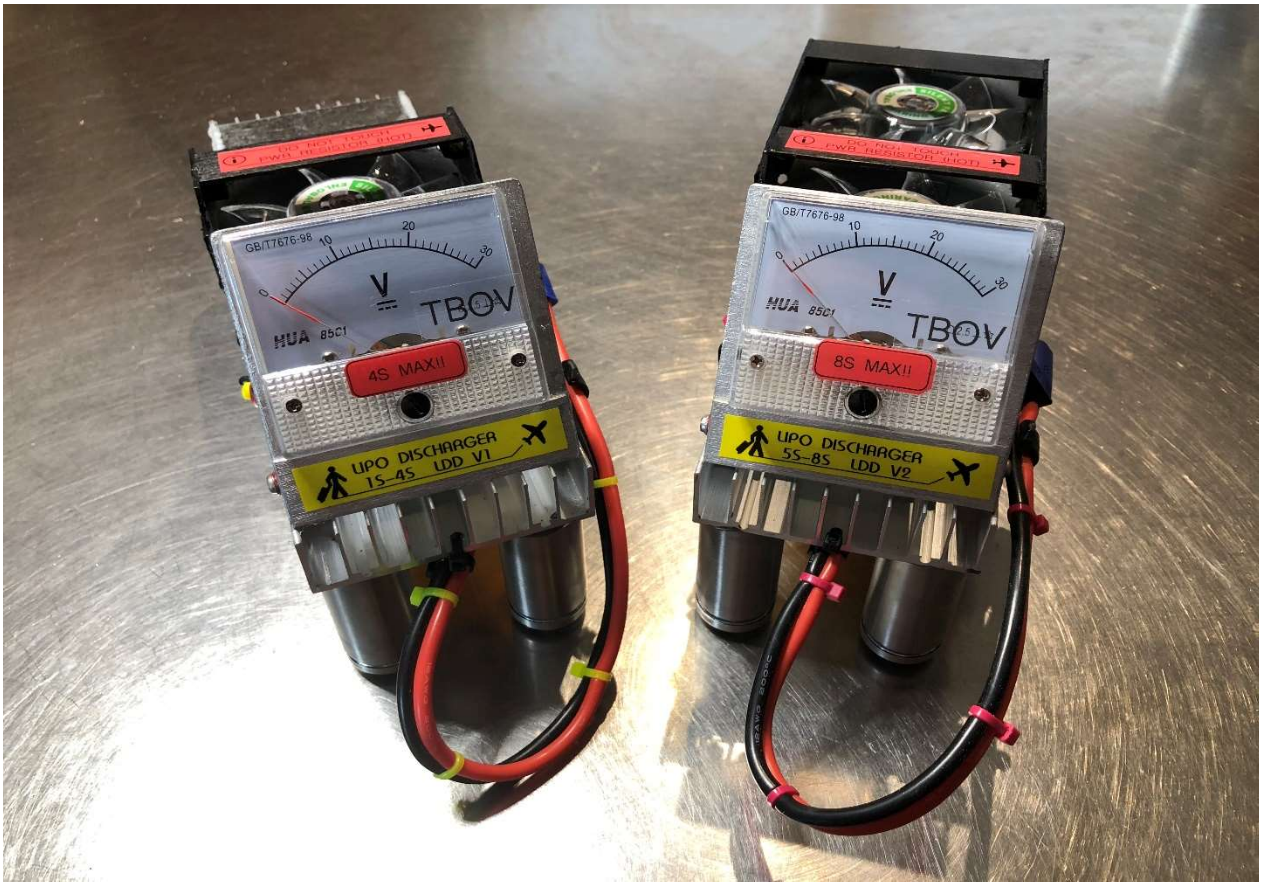
1. Balance charge the battery to 100% or 4.2 volts per cell.
2. Connect a LiPo cell voltage monitor to the battery's balance connector.
3. Connect a wattmeter/power analyzer (i.e. "Watts Up") to the battery's power connector and connect the wattmeter/power analyzer load connecter to the LDD.
4. Monitor all cell voltages during the discharge cycle. The voltage of each cell should decline at an even rate. Any cell voltage that varies significantly from the others could indicate a defective cell.
5. Monitor the wattmeter/power analyzer display. When the total discharge Ah reading reaches 1/2 of the total battery mAH rating disconnect the battery from the LDD. For example; disconnect a 2600 mAH pack as soon as the wattmeter/power analyzer indicates that 1800 Ah has been used from the battery. **Do not go lower than 3.4 volts per cell during this check.**
6. Let the battery rest for 5 minutes and then check all cell voltage levels, each cell should be around 3.8 volts. Any cells reading significantly less than 3.8 volts indicates that the battery may no longer have its fully rated capacity and it should be carefully monitored if you continue to use it.

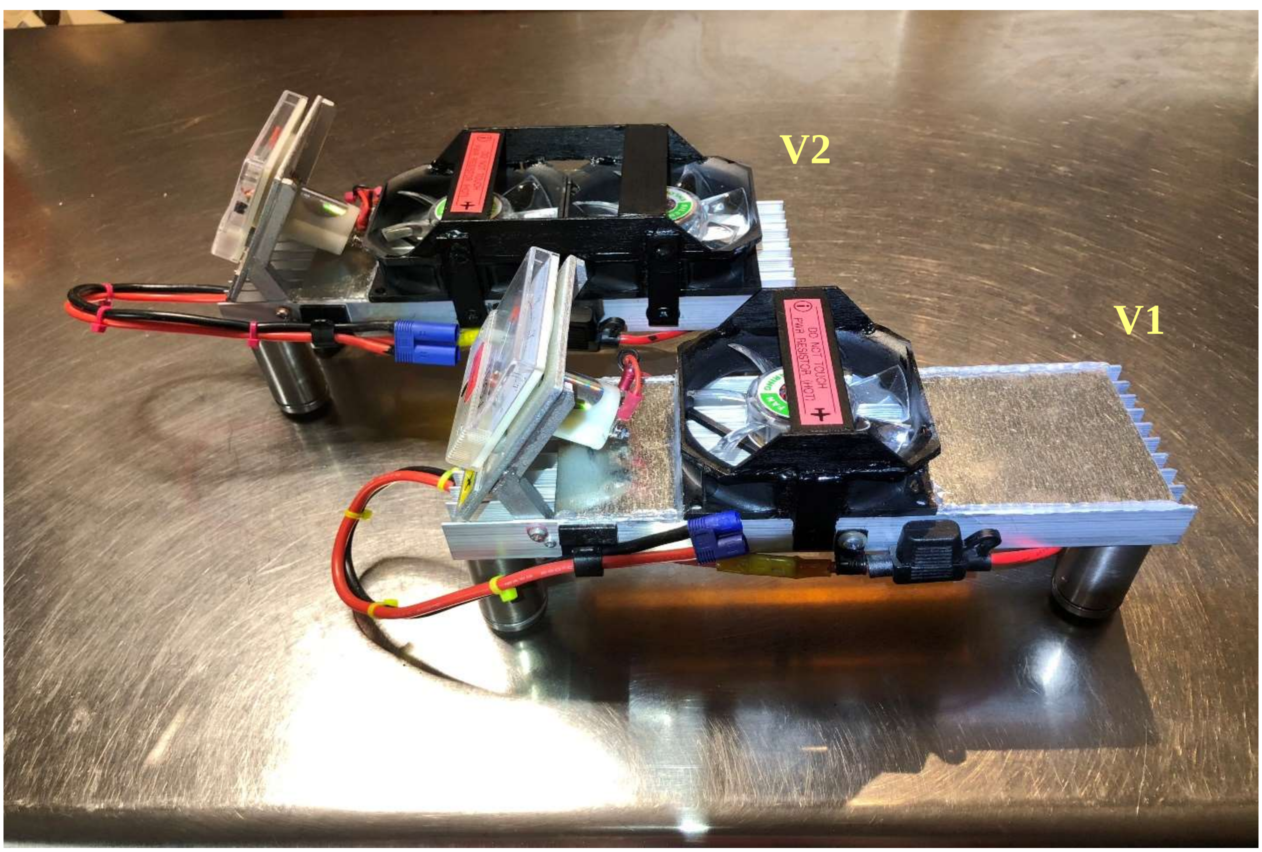
<u>LiPo Battery Disposer Cycle Procedures</u>

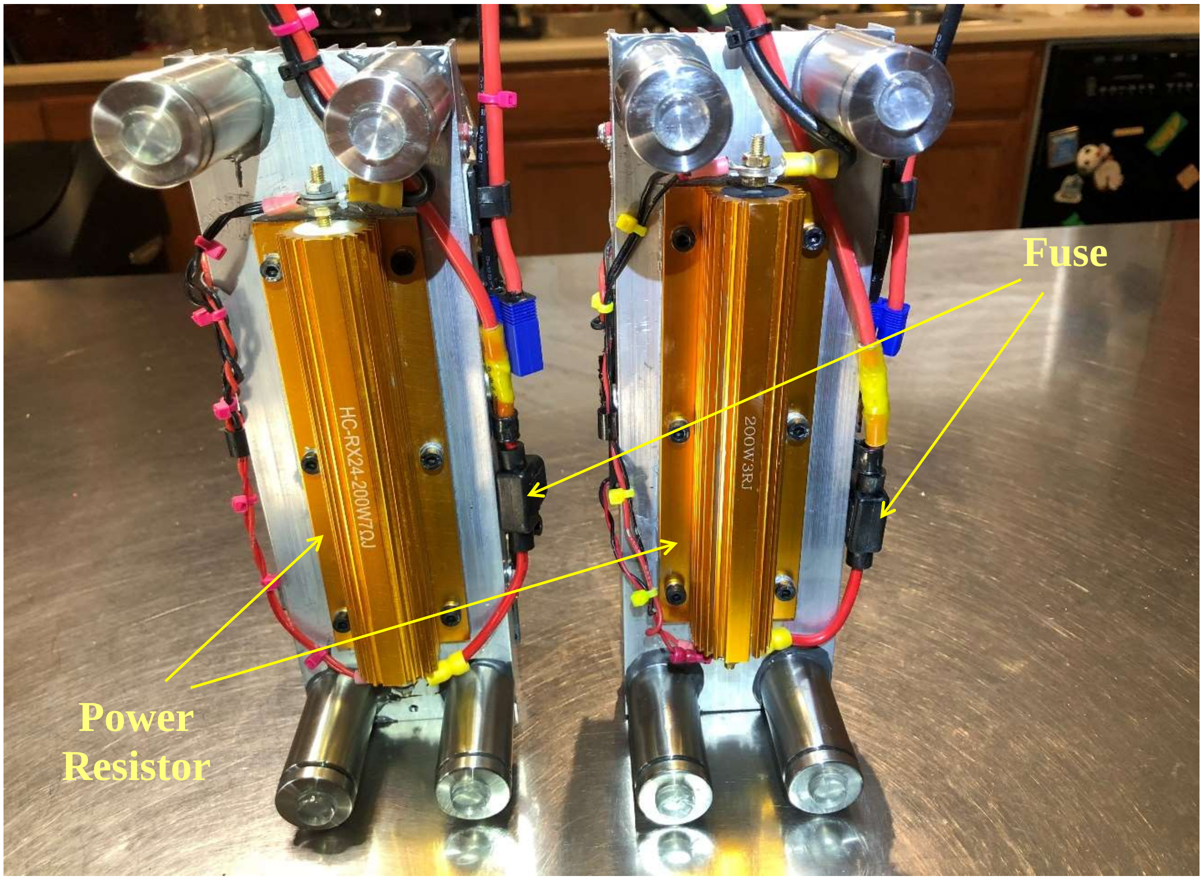
1. Connect the battery to the LDD connector.
2. Monitor the discharge cycle closely, <u>do not leave battery unattended</u>.
3. Disconnect battery from the LDD when the **TBOV i**s less than 1 VDC (as read on the panel meter or the external multimeter).
4. Cut off the battery power connector and strip the red and black wires.
5. Twist the red and black wires together and secure with electrical tape.
6. Set the battery in a safe location overnight.
7. Place the battery in the trash or recycle if available.

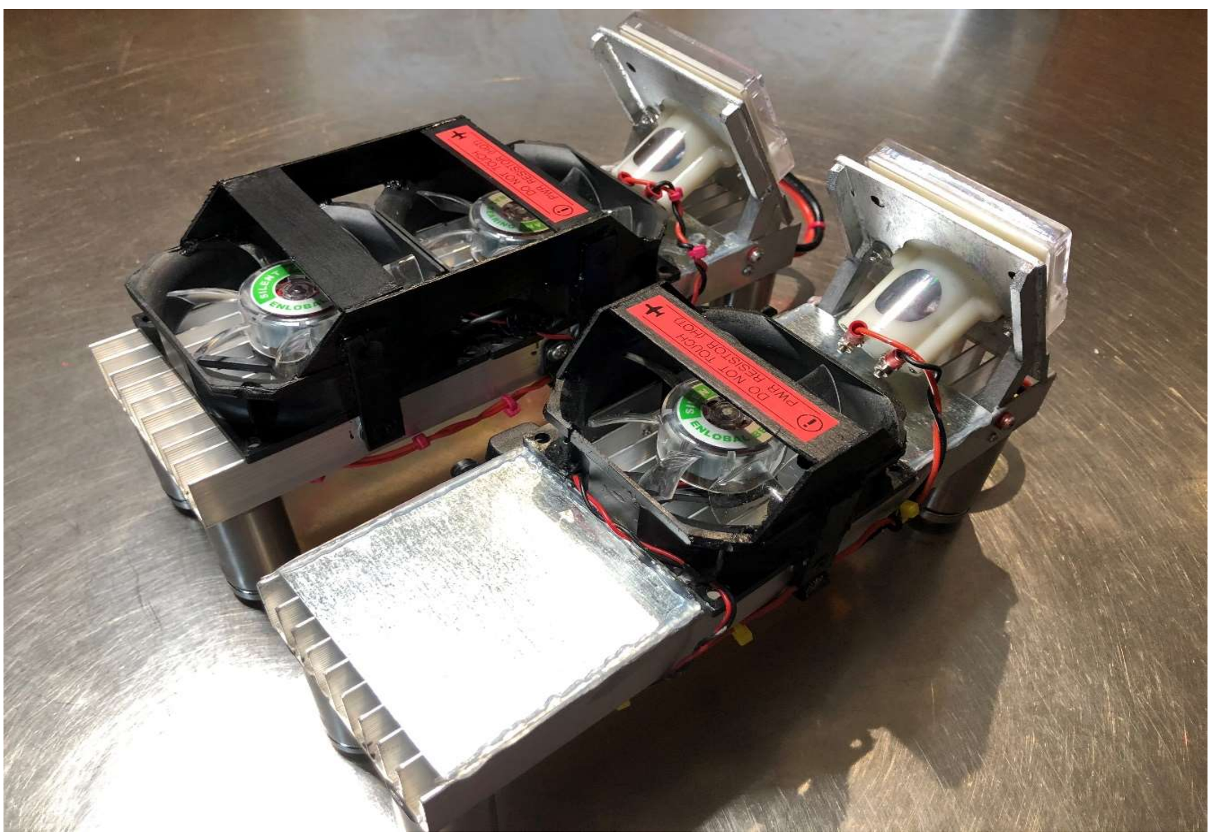
WARNING!

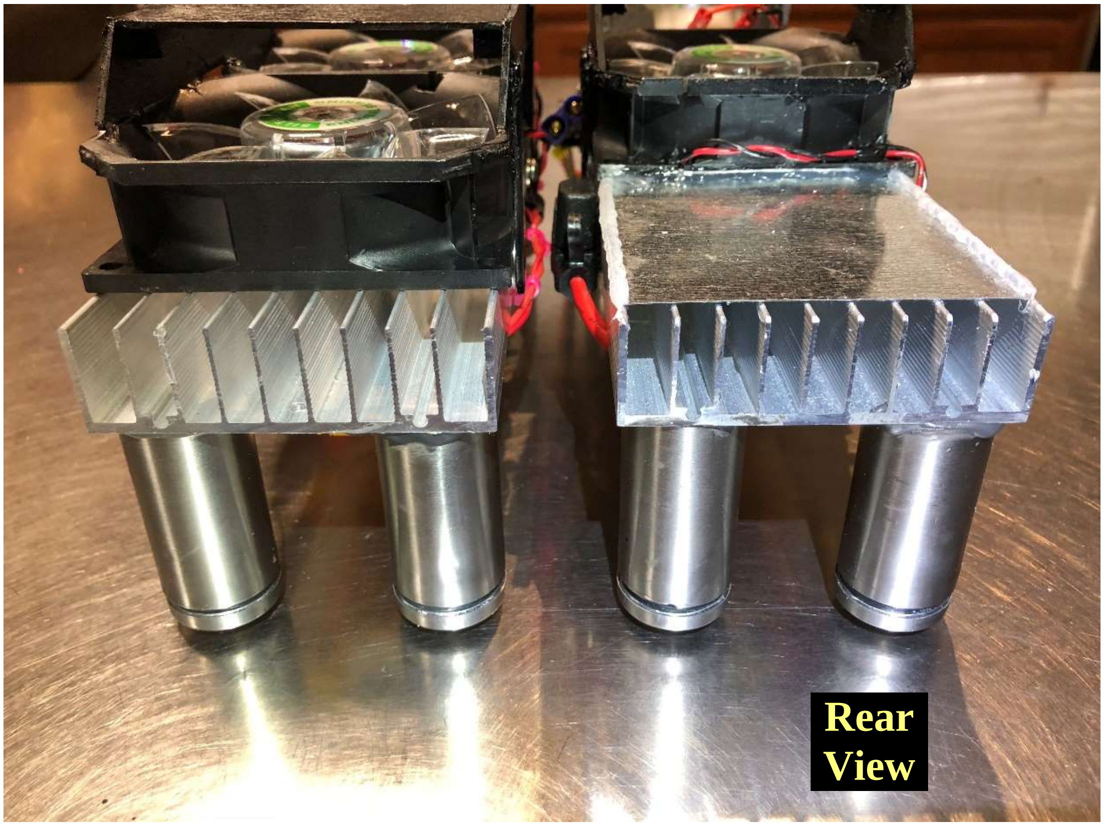
- The battery <u>will get warm</u> and start to swell (puff) at approximately 2.8 volts per cell.
- The battery will typically reach its maximum external temperature, and maximum puffed size, at approximately 1.2 volts per cell.
- The LDD cooling fan will quit when the **TBOV** reaches approximately 2.8 volts for the V1, and 5.6 volts for the V2. At this voltage the battery has lost most of its energy and the cooling fan(s) are no longer needed.
- If you are not accustomed to watching a dying LiPo get hot and puff it can be quite a disconcerting event. All the batteries I have disposed of using this method have never burst or leaked as the pack/cell sleeving has always stretched enough to contain any cell expansion. The safest practice however would be to place the battery into a suitable size open container (i.e. 1-quart paint can) during the full discharge cycle. You could also add tap water to the container (just enough to submerge the battery) which will help reduce the battery's overall temperature as it becomes inert.


DO NOT TOUCH
PWR RESISTOR (HOT)
GB/T7676-98
HUA 85C1
TBOV
4S MAX!!
LIPO DISCHARGER
1S-4S LDD V1
8S MAX!!
LIPO DISCHARGER
5S-8S LDD V2


V2
V1
DO NOT TOUCH
PWR RESISTOR (HOT)

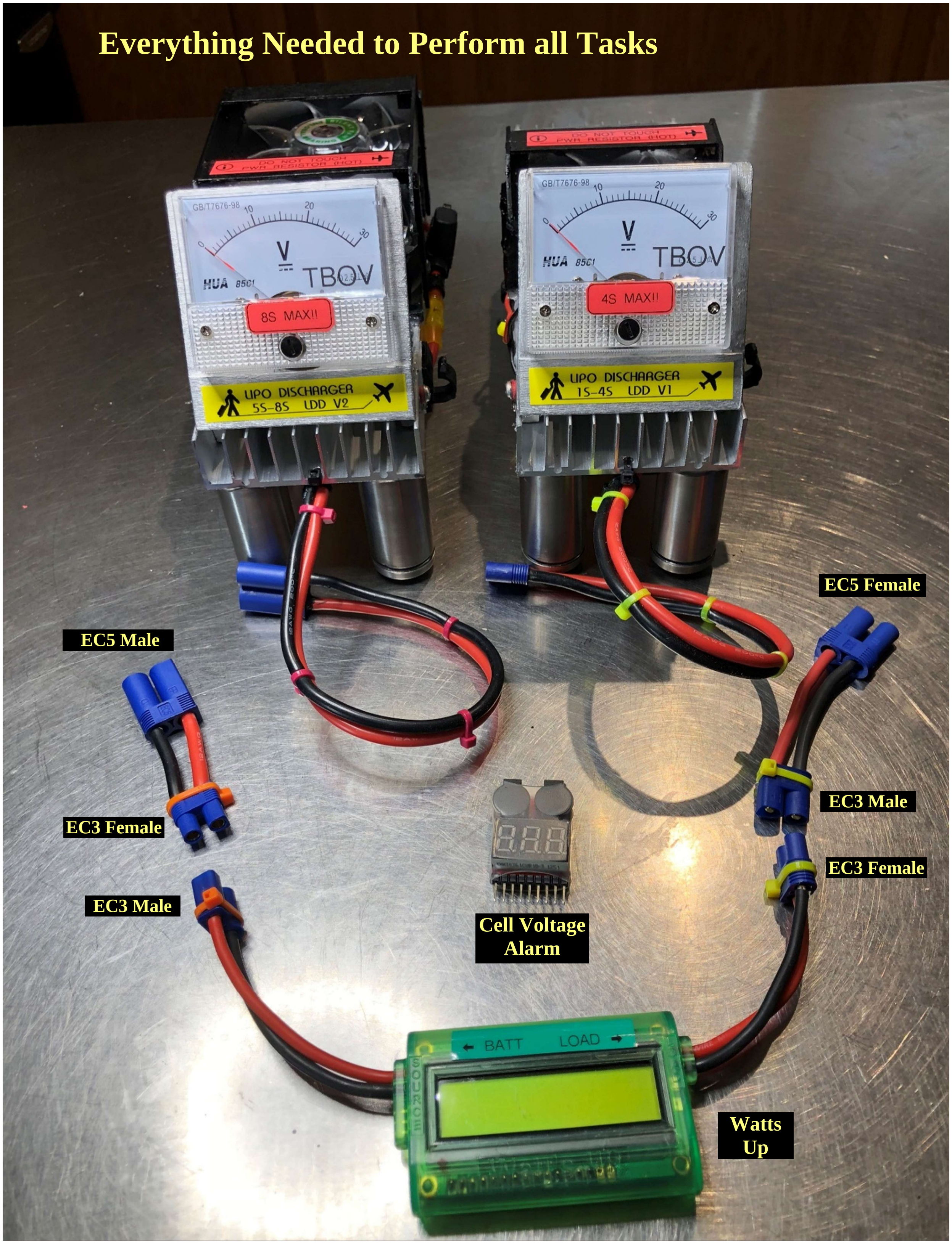

Fuse
Power
Resistor




Rear
View


Storage Cycle


Condition/Capacity Check
ADMIRAL
4S 14.8V
3600 mAh
40C


Everything Needed to Perform all Tasks
DO NOT TOUCH PWR RESISTOR (HOT)
8S MAX!!
LIPO DISCHARGER 5S-8S LDD V2
4S MAX!!
LIPO DISCHARGER 1S-4S LDD V1
EC5 Male
EC5 Female
EC3 Female
EC3 Male
EC3 Male
EC3 Female
Cell Voltage Alarm
BATT
LOAD
SOURCE
Watts Up