



dragonfly[®]
ENERGY



Model DF5024 Manual and Installation Guide

Dragonfly Energy Corp.

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Please read this manual prior to installation and use.

Thank you for investing in a Dragonfly Energy system and welcome to the Dragonfly Energy family. This manual provides important information on how to install, operate, and care for your Dragonfly Energy batteries. If you have purchased with us before, you will find this manual useful as a reference tool. If this is your first purchase with Dragonfly Energy, this manual can serve as an educational tool on how to properly use and care for your investment.

If you have a heat-enabled model, please refer to the additional Heat-Enable Instruction manual prior to use and installation.

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Caution: Risk of Fire and Burns. Do Not Open, Crush, Heat Above 150°F or incinerate. Follow Manufacturer's Instructions



Attention, Risque d'incendie et de brulures. Veuillez ne pas ouvrir, percer, ou exposez à une chaleur égal ou supérieur à 66° C. Neas mettre dans le feu. Veuillez suivre les instructions du fabric

What is in the Box?

Included with your purchase is:

- (1) DF5024 Dragonfly Energy battery
 - Dimensions (L x W x H): 12.76" x 6.86" x 8.95"
 - Weight: 31 lbs.
 - Operating Temp Range: 4°F (-20°C) to 135°F (57.2°C)
 - Water Resistant and Sealed (Batteries should not be submerged)
 - Built-in BMS (Battery Management System)
 - Made with Cylindrical Cells
 - Comes with standard flag style terminal posts with a 3/8" hole to accommodate either a 3/8" or a 5/16" bolt
- (1) Finishing Hardware Kit
 - (2) '18-8 Stainless Steel' 5/16-18 x 1" Bolts
 - (2) '18-8 Stainless Steel' 5/16-18 x 1 1/4" Bolts
 - (4) Washers
 - (2) Nylok Nuts

What Do I Need for Installation?

If you already have your system set up and are ready to drop in your batteries, you will need a torque wrench that is able to fit to and properly torque your 5/16" finishing hardware. This is REQUIRED to make sure that you torque to the specification of 9 to 11 ft-lbs., otherwise you may cause system failures and damage.

Connecting Load Specified Cables to the Batteries

1. Identify the positive and negative terminals. These are labeled and color-coded **red for positive (+), black for negative (-)**.
2. Determine which finishing hardware set you will use. Verify that your bolt can fully seat into the nylok insert of the nut.
3. Connect your cable lugs to your battery terminal with the previously identified finishing hardware set. Make sure to connect your positive load specified cable lug to the positive terminal and the negative load specified cable lug to the negative terminal. The proper order to connect to your terminal with a finishing kit is shown in Fig. 1.

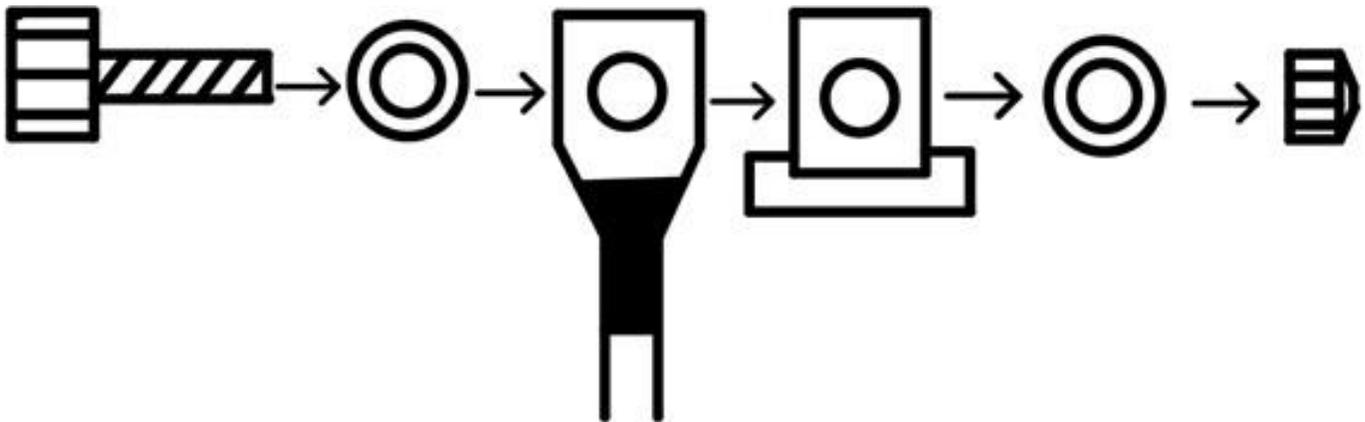
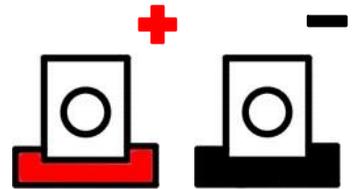


Figure 1: Proper order of hardware to connect cables. When going from left to right in the diagram the correct order is: bolt, washer, lug, terminal, washer, and nut. If multiple lugs are used, they should be on the same side of the terminal.

4. When connecting to your battery terminals, **DO NOT** finger tighten. Use a torque wrench to torque your hardware to the specification of 9 to 11 ft-lbs. Failure to adequately secure connections can result in severe damage and will void your warranty. Fig. 2 below demonstrates proper and improper connections.

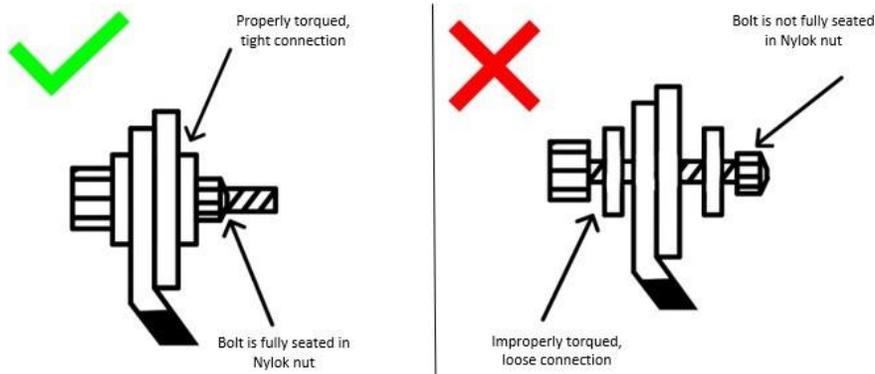


Figure 2: Proper and Improper Terminal Connections

Connecting the Batteries in Parallel

Why Connect in Parallel?

Multiple DF5024 batteries may be connected in parallel to increase the capacity and current of the system. When batteries are connected in parallel, the voltage of the system does not change, but the capacity and current limits are additive. For example, two DF5024 batteries connected in parallel (shown in Fig. 3) create a 24V 100Ah bank that can deliver 120A continuously and 200A for 30 seconds.

How to Make a Parallel Connection

NOTE: All cables and connections MUST be able to accommodate the high currents that can be delivered by the battery. Appropriate fuses and circuit breakers are highly recommended to protect downstream components from current spikes and short circuits.

1. Identify the positive and negative terminals. These are labeled and color-coded **red for positive (+)**, **black for negative (-)**.
2. Determine the appropriate finishing hardware set you will use. Verify that your bolt can fully seat into the nylok insert of the nut. If multiple lugs are used, longer bolts may be required for the bolt to fully seat into the nylok insert of the nut.
3. Make the proper cable connections to the positive of the first battery. Please reference Fig. 1 for the proper order of hardware.
4. When connecting to your battery terminals, **DO NOT** finger tighten. Use a torque wrench to torque your hardware to the specification of 9 to 11 ft-lbs. Failure to adequately secure connections can result in severe damage and will void your warranty.
5. Connect the other end of your positive cable to the positive terminal of the other battery you are connecting to. Repeat step 4.
6. Repeat steps 3-5 for the negative connections.
7. Repeat steps 3-6 for additional batteries in the system. An example of a finished connection can be found below in Fig. 3.

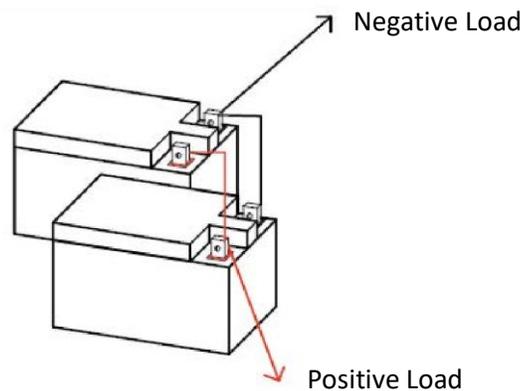


Figure 3: Two 5024 Batteries connected in Parallel to create a 24V 100Ah Battery Bank

Connecting the Batteries in Series

Why Connect in Series?

When batteries are connected in series, current capacities remain the same, but the system voltage is additive. For example, two DF5024 batteries connected in series form a 48V 50Ah bank (shown in Fig. 4) and should be charged using a bulk and absorption voltage of 57.6V, and a float voltage of 54.4V.

How to Make a Series Connection

Note: DF5024 Batteries are capable of being connected in series up to 48V. DO NOT exceed a 48V setup or you will void the batteries' warranty.

1. Before making any connections, make sure to charge each battery up to 29.2V with a proper lithium charger. ALL BATTERIES SHOULD BE AT THE SAME STATE OF CHARGE PRIOR TO CONNECTING, otherwise you will encounter balance issues within your system. You can check your battery's state of charge with a multimeter.
2. Identify the positive and negative terminals. These are labeled and color-coded **red for positive (+)**, **black for negative (-)**.
3. Determine the appropriate finishing hardware set you will use. Verify that your bolt can fully seat into the nylok insert of the nut. If multiple lugs are used, longer bolts may be required for the bolt to fully seat into the nylok insert of the nut.
4. Make the proper cable connections to the negative of the first battery. Please reference Fig. 1 for the proper order of hardware.
5. When connecting to your battery terminals, **DO NOT** finger tighten. Use a torque wrench to torque your hardware to the specification of 9 to 11 ft-lbs. Failure to adequately secure connections can result in severe damage and will void your warranty.
6. Connect the other end of your cable to the positive terminal of the other battery you are connecting to. Repeat step 4.
7. Repeat steps 3-6 for additional batteries, but **DO NOT** exceed 48V. An example of a correct series connection can be found below in Fig. 4.

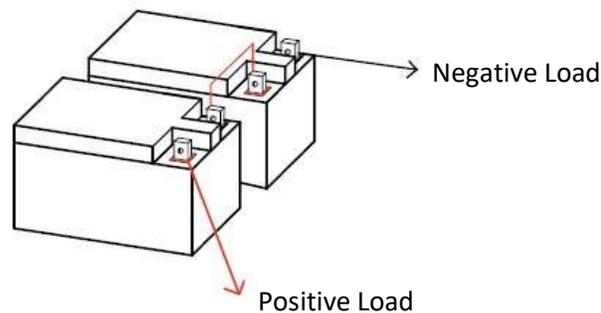


Figure 4: Two 5024 Batteries Connected in Series to create a 48V 50Ah Battery Bank

How to Properly Charge the Batteries

To properly charge your Dragonfly Energy batteries, you will want to verify that any charging component in your system is capable of being programmed for the following specifications. Charging components can include, but are not limited to converters, inverter chargers, solar charge controllers, DC to DC chargers, etc.

- Bulk/Absorption: 28.4V – 29.2V
- Absorption Time: 30 minutes per battery (for parallel string)
- Float: 26.8V – 27.6V
- Equalization: 28.8V/ Disabled
- Temperature Compensation: 0/Disabled
- Charge Rate: .5c
- Battery Charge Temperature Range: 25°F (-3°C) to 135°F (57.2°C)
- Battery Discharge Temperature Range: -4°F (-20°C) to 135°F (57.2°C)
- Cell Charge Temperature: 32°F (0°C) to 131°F (55°C)
- Cell Discharge Temperature: 68°F (20°C) to 140°F (60°C)

NOTE: Not all chargers are capable of multistage charging. If yours is not, you will want to verify it can be programmed for the Bulk/Absorption voltage and have the other items mentioned disabled if applicable. Consult your charger's manual or the manufacturer.

How Does the BMS Protect the Batteries?

All Dragonfly Energy batteries come with a built-in battery management system (BMS) that protects the cells from many strenuous circumstances to protect the life cycles of the cells and your electrical system from potential damage. The BMS in the DF5024 allows for 60 Amps continuous, 100 Amp surge for 30 seconds, and 1/2 second surge for loads over 100 Amps. All of our BMS' protect against the following conditions:

High Voltage Disconnect (> 14.7V)

If an individual cell voltage exceeds a prescribed threshold during charging, the BMS will prevent a charge current from continuing. Discharge is always allowed under this condition. If the batteries have not been balanced for a long time, high voltage disconnect could occur at a lower voltage. The batteries will rebalance after several full charges.

Low-Voltage Disconnect (< 10.6V)

If an individual cell falls below a prescribed threshold during discharge, the BMS will prevent further discharge. Although the battery is in "low-voltage disconnect" mode, it will still allow a charging current.

NOTE: Many chargers must detect a voltage over 10V to send a charge to the battery. Please be aware that some chargers may not sense a battery in low-voltage disconnect and you may need to jump it with a 12V source to "wake up" the battery. You should jump your battery within 24hrs of entering low-voltage disconnect otherwise you risk damaging your battery and voiding the warranty.

High Temperature Charging and Discharging (> 135°F/57.2°C)

The BMS will not allow a charging or discharging current if the internal temperature of the battery has reached 135°F (57.2°C).

Low Temperature Charging (< 25°F/-3.9°C)

The BMS will not allow a charging current under 25°F (-3.9°C) but will continue to discharge down to -4°F (-20°C).

NOTE: The DF5024 has an operating temperature range of -4°F (-20°C) to 135°F (57.2°C).

High Current Discharge Surges

The BMS will not allow a current that exceeds 100 (+/- 5%) Amps for more than 30s, or anything larger for 0.5s. After a high current disconnection, the battery will automatically reconnect after 5 seconds.

Short Current Discharge Surges

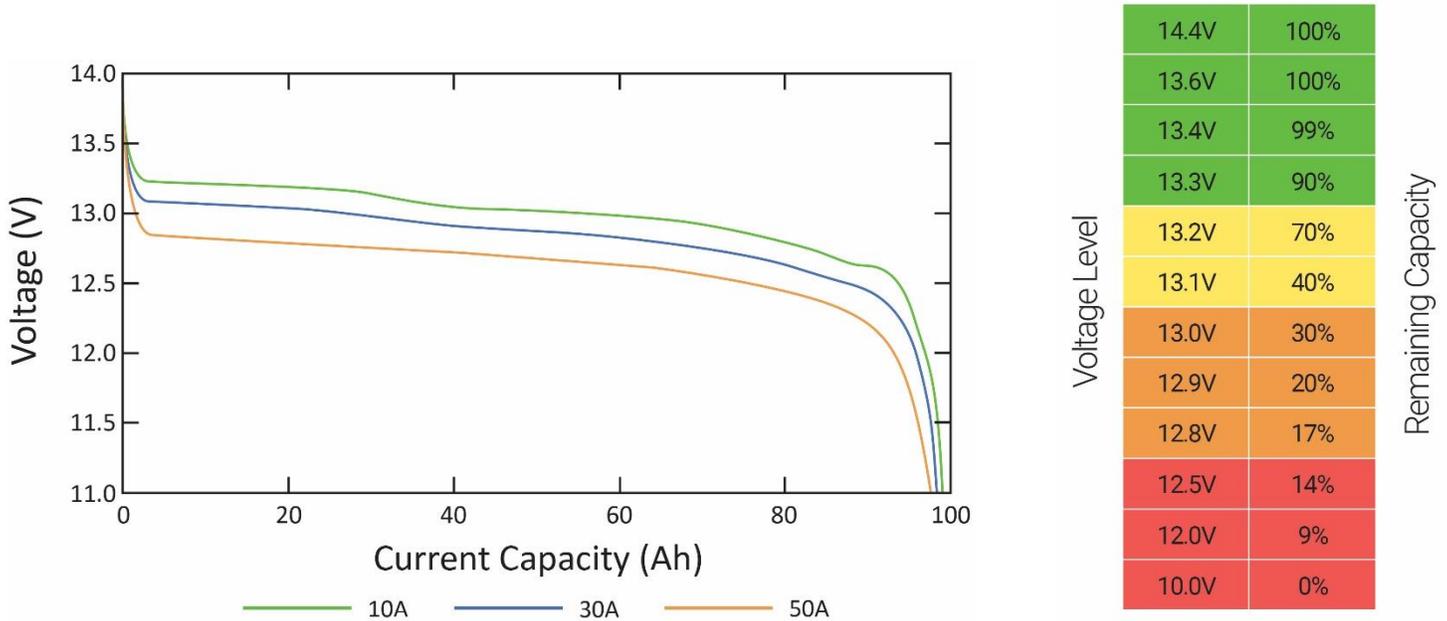
Our BMS has built-in short circuit protection. If the short circuit protection is tripped, the BMS will shut the battery down and will remain disconnected until you remove the battery cables. While the battery cables are disconnected, we suggest taking the voltage of the battery with a voltmeter. If it reads above 10V, reconnect the battery cables. If you are unsuccessful at obtaining a voltage reading above 10V, please give our technical support team a call.

Balancing of Cells

A passive balancing process is activated by the BMS at the top of each charge cycle when the battery voltage exceeds around 28.4V. This ensures that all the cells remain at the same state of charge, which helps pack longevity and performance.

Voltage vs. Capacity

For a Single Battery



How to Properly Size Cables for System Install

When considering cable sizing there are a few factors to consider. First, what is the size of the load you are powering with the battery bank? Second, how far away from the battery is the load? You can do voltage drop calculations to see if you need to step up your cable size. Fig. 5 is a chart to use for reference. Do keep in mind that cables are only capable of carrying a certain amperage and you should verify the specifications of your cable and the power draws before implementing them into your system to avoid potential failures and damage.

CURRENT (A)	LENGTH IN FEET							
	0-5	4-7	7-10	10-15	15-20	20-25	25-30	
0-5	16 AWG	16 AWG	16 AWG	16 AWG	14 AWG	12 AWG	12 AWG	
5-10	16 AWG	16 AWG	14 AWG	12 AWG	10 AWG	10 AWG	10 AWG	
10-15	14 AWG	14 AWG	12 AWG	10 AWG	10 AWG	8 AWG	8 AWG	
15-20	14 AWG	12 AWG	12 AWG	10 AWG	8 AWG	6 AWG	6 AWG	
20-25	12 AWG	10 AWG	10 AWG	8 AWG	6 AWG	6 AWG	6 AWG	
25-30	10 AWG	10 AWG	10 AWG	8 AWG	6 AWG	6 AWG	4 AWG	
30-40	8 AWG	8 AWG	8 AWG	6 AWG	6 AWG	4 AWG	4 AWG	
40-50	8 AWG	8 AWG	6 AWG	6 AWG	4 AWG	4 AWG	2 AWG	
50-60	6 AWG	6 AWG	6 AWG	4 AWG	4 AWG	2 AWG	2 AWG	
60-70	6 AWG	6 AWG	4 AWG	4 AWG	2 AWG	2 AWG	1/0 AWG	
70-80	4 AWG	4 AWG	4 AWG	4 AWG	2 AWG	2 AWG	1/0 AWG	
80-90	4 AWG	4 AWG	4 AWG	2 AWG	2 AWG	1/0 AWG	1/0 AWG	
90-100	2 AWG	2 AWG	2 AWG	2 AWG	2 AWG	1/0 AWG	1/0 AWG	
100-120	2 AWG	2 AWG	2 AWG	2 AWG	1/0 AWG	1/0 AWG	2/0 AWG	
120-150	1/0 AWG	1/0 AWG	1/0 AWG	1/0 AWG	1/0 AWG	2/0 AWG	4/0 AWG	
150-200	2/0 AWG	2/0 AWG	2/0 AWG	2/0 AWG	2/0 AWG	4/0 AWG	4/0 AWG	

Figure 5: As a rule of thumb, you can use these numbers as a guideline.

How to Incorporate Fuses into System Install

ANL fuses are designed to melt and separate into two pieces for the purpose of breaking a circuit in the event of excessive current. These fuses are essential components for protecting against a catastrophic event and are typically placed between Dragonfly Energy batteries and the inverter/load.

How to Properly Store Batteries

We recommend bringing the Dragonfly Energy batteries to a 100% state of charge. Then, disconnect the battery from any loads by removing the negative cable from one battery. On average, the batteries lose approximately 2-3% capacity per month. This is subject to increasing if stored in extreme environmental conditions.

How to Maintain the Batteries

Dragonfly Energy batteries require very little maintenance. If your batteries are in series and not being charged by a multi-bank charger it is recommended that you fully charge the batteries individually once a month if the system is used frequently. This will internally balance your batteries to ensure that they will reach their expected life span and allow you to get the full power out of them with each use. If your batteries are in parallel this is not necessary, just make sure the batteries are charged to 14.2V – 14.6V frequently for internal balance. Our BMS has a built-in passive balancing system that will take care of this for you.

How to Properly Recycle and Dispose of the Batteries

Here at Dragonfly Energy our goal is to provide our customers with long lasting green energy that will support them for years on all their adventures. That is why we not only build batteries that can keep up with you for a long time but also provide industry leading customer support to help you get the most out of your batteries. When the time does come, and your batteries have reached the end of their lifetime it is important to recycle them responsibly.

Here are a few suggestions:

1. Make sure all loads are removed from your system before removing the batteries. Once the batteries are removed cover the terminals using electrical tape. Now can be a good time to inspect any cable runs or lugs.
2. Visit www.earth911.com or www.call2recycle.org/locator to find a drop off location. Be sure to call ahead of time to confirm that the drop off location is still accepting materials.
3. Give us a call if you are having any trouble finding a drop off location and we can help you find one.

If you have any questions, please contact us by calling 833-224-12902 or email us at info@dragonflyenergy.com

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