

# Firefly User's Manual for the "OASIS" G31 & the L15+

July 2018



## **Congratulations on your purchase of a Firefly Oasis Battery!**

The Firefly batteries use a patented carbon Microcell Foam grid structure that is highly resistant to sulfation and grid corrosion. They have the longest life of any lead acid battery used for deep cycling, even at extreme temperatures and operation at less than full charge.

The Firefly batteries can have four times the life and two times the energy density of a traditional lead acid battery:

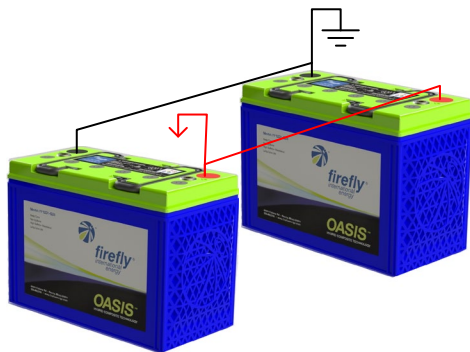
- Plate corrosion is inhibited.
- Plates are resistant to sulfation
- The high plate porosity allows the electrolyte to react more efficiently.

## **Installation**

### **MOUNTING ORIENTATION**

Both the G31 and the L15+ batteries can be installed in any orientation other than inverted without compromising the operation of the battery.

### **PARALLEL INSTALLATION**



### **SERIES INSTALLATION**





#### L15+ 4V CONNECTION

The battery will be shipped with the connection bar shown on the left. This connects the 2 cells inside the module in series making the battery 4V and 450Ah.



#### L15+ 2V CONNECTION

If you want to change the module to 2V 900Ah, you will need to change the connection bars on top to connect the positive terminals together and the negative terminals together as shown to the left. The hardware to make these connections is not included with the battery. The cables or bars used must be rated for the total amps possible of all loads on the system combined.

### CONNECTING THE BATTERY

Take care not to short circuit the terminals on the battery. Make sure the terminals and connectors are clean and free of corrosion. Connect the positive cable to the positive (+) battery terminal. Connect the negative cable to the negative (-) battery terminal. The terminals on the G31 are 3/8-16 UNC and should be torqued to 16 ft lbs.

### Operation & Charging

- Firefly batteries can be operated in a partial state of charge for long periods of time without sustaining any permanent damage.
- The batteries may emit gas during the first 10-20 charge cycles. This is normal.
- The maximum recommended discharge current is 0.7C for extended periods of time to ensure the longevity of the battery. The FF battery can discharge faster than that for short periods.
- If you have hardware that requires a Peukerts constant to be entered, we recommend that you do not change the factory settings due to the large inaccuracies based on varying discharge rates. The Peukerts constant for the FF battery for the 10hr and 20hr rate is 1.07. It is 1.12 for 6.5hr and 1.8hr rate. Keep in mind that whatever Peukerts correction you use, you will lose accuracy with extremely slow discharges.
- If you have hardware that allows the user to enter a temperature coefficient, use 24mV/C° for temperature compensation.
- For a complete charge cycle, charge the G31 to 14.4V/L15+ to 4.8V with temperature compensation (bulk phase) and continue charging until the charging current drops to 1.5A for the G31 or 6A for the L15+ (absorption phase time will vary). You DO NOT need to fully charge the batteries each cycle in order to maintain the capacity and only need to perform a complete charge cycle when you want to maximize the capacity for the following discharge cycle.

- For charging sources that may be charging the battery for an extended period of time (solar, or an alternator if motoring for a while); set the float voltage to 13.4V for the G31 and 4.5V for the L15. Firefly batteries do not require a float charge. But, if you are float charging, due to their longer projected lifespan, it is important to keep the float voltage at 13.4V (4.5V for L15+) to ensure the battery lasts for as many cycles as possible. Reset to bulk phase: for programmable charging sources, adjust the “reset to bulk phase” to occur if the battery voltage drops below 12.0V for >1 minute for the G31 or 4.0V for >1 minute for the L15+.
- For repetitive deep cycling, note that periodic fast charging has a positive impact on effective battery capacity. If deep cycling, ideally once or twice per week, the batteries should be charged at a current of 0.4C or more (40 Amps for a 100 Ah battery), or at least 25A per battery. Note that periodic fast charging can help restore usable capacity after periods of constant slow charging after deep discharge cycles. For applications lacking fast charging capability, contact OPE or Firefly USA for alternative restoration procedures. Due to the low impedance design, Oasis batteries can tolerate in-rush current levels as high as 3C (300A for a 100Ah battery).
- The optimum operating temperature for a lead-acid battery is 25°C (77°F). As a rule of thumb, every 8-10°C (14-18°F) rise in temperature will cut the battery life in half. Note that continuous duty at elevated temperature will shorten the life of any battery.

## **Restoration Charge**

As stated, Firefly Batteries can operate in a partial state of charge for long periods of time without sustaining any permanent damage. The usable capacity will decrease, however, with each cycle within a partial state of charge, up to a point. In order to regain the full original capacity and in some cases more, it is necessary to perform a restoration charge. To perform the restoration charge: charge the G31 to 14.4V or the L15+ to 4.8V and continue to charge until the current drops to 0.6 A on the G31 or 3A on the L15+. Fully discharge the battery to 10.5V (G31) or 3.5V (L15+), and then repeat the same charge cycle. At this point, the battery should have regained full capacity.

## **Safety**

### **EMERGENCY AND FIRST AID PROCEDURES**

**Battery Electrolyte Eye Contact:** Immediately remove any contact lenses if present. Flush eyes with water for at least 15 minutes. Seek medical attention immediately.

**Skin Contact:** Remove contaminated clothing. Flush with water for at least 15 minutes. Seek medical attention immediately.

**Inhalation:** Remove to fresh air. If not breathing give artificial respiration. If breathing is difficult give oxygen. Seek medical attention immediately.

**Ingestion:** Do not induce vomiting. If conscious dilute by drinking water or milk. Do not give anything by mouth to an unconscious person. Seek medical attention immediately.

### **PRECAUTIONS FOR SAFE HANDLING AND USE**

Steps to be taken in case of a broken battery case or electrolyte leakage: neutralize spilled electrolyte and exposed battery parts with soda ash, sodium bicarbonate, lime, etc. Do not use organic or combustible material. Wear acid resistant clothing, boots, gloves, face shield, and proper respiratory protection.

Waste Disposal Information: Please observe all federal, local, and state regulations regarding the disposal of lead/acid batteries.

Precautions to be taken in Handling, Storing, and Transportation: Store in cool, dry area away from combustible materials; store in well ventilated areas. Other Precautions: Do not charge in unventilated areas.

## **Shipping, storage and disposal**

### **VIBRATION RESISTANCE**

The carbon foam batteries have been used under conditions of extreme vibration and impact in applications such as transit buses - carbon foam plates have higher yield strength than lead plates and have high compressive strength.

### **D.O.T. REGULATIONS-NONSPILLABLE**

Firefly's Group 31 battery meets the non-spillable criteria. It is exempted from CFR 49, Subchapter C requirements, which translates to no proper shipping name, no hazardous class, no UN number, no packaging group and no hazardous labels when transporting, provided that the following criteria are met: 1. the batteries must be protected against short circuits and securely packaged. 2. The batteries and their outer packaging must be plainly and durable marked "NON- SPILLABLE" or "NON-SPILLABLE BATTERY".

### **SHELF LIFE**

Unlike other lead acid batteries that require a recharge as frequently as every six weeks in order to avoid permanent damage, the Oasis battery can be stored for up to two years at 25°C (77°F) from a fully charged state. They will discharge at a rate similar to other lead batteries but the sulfation that naturally occurs when discharging will not cause permanent damage. However, for better life cycle, it is recommended to recharge the Firefly battery at least every 6 months.

### **FULLY-CHARGED WHEN SHIPPED**

The Oasis will be shipped from the factory fully charged. Some venting from the valves is possible when it arrives.

### **RECYCLING**

There is an existing infrastructure to recycle lead acid batteries. Because Firefly's technology uses carbon, it actually decreases the amount of lead in the battery. Firefly's microcell technology can be recycled through the existing lead acid infrastructure.