Firefly User's Manual for the "OASIS"

L-16 (4V450Ah @ C20)

2026

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 compared to any other VRLA battery used for deep cycling, even at extreme temperatures and can be operated at less than full charge.

The Firefly batteries have many advantages over a traditional VRLA battery:

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

Receiving & Refreshing Charge

- Check the Individual battery voltages, it will be around 4.30 V for a fully charged L16(4V450Ah)Battery.

- Freshening charge shall be carried out using a CCCV (Constant Current _Constant Voltage charger within built Temperature compensation.

- In case the OCV (Open circuit voltage) of the battery is less than 4.20 V for the L-16(4V450Ah) battery they need to be charged @ 4.70 V/ battery (.i.e. @2.35 V / cell) for 12 hrs. before commissioning with the current limit ranging from 0.1C Amps to 0.5C Amps Maximum.

INSTALLATION

MOUNTING ORIENTATION

- All Firefly batteries can be installed in upright position OR on its Length / width sides in racks.

- Only upside-down orientation is not allowed.

SPACE AND VENTILATION

- The batteries should be installed with a minimum of 0.6 inch (1.52 cm) between batteries to allow for proper ventilation and air circulation. If space allows, 1 inch (2.54cm) between batteries is recommended for ideal operation.
- There also needs to be adequate space in the compartment for ventilation.
- If possible, mount the batteries on low stand-offs to encourage air circulation around their bases.
- Keeping batteries in unventilated rooms/enclosures is dangerous as it might result in Explosion. Fire and personal injury to those in the vicinity when electrical spark / flames are introduced.
- It would be better to have exhausts, Hydrogen sensors and keep hydrogen concentration below 4% as small amount of hydrogen is released by batteries even when stored / charged that accumulates over a period of time.

FOLLOW ALL ABYC INSTALLATION GUIDELINES

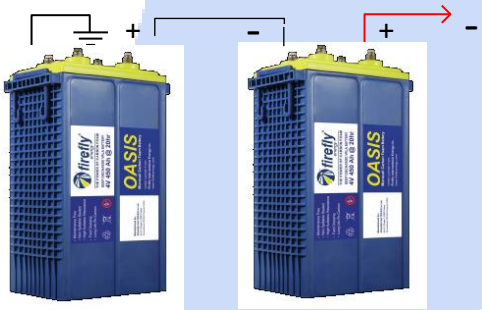
- The batteries should be fastened securely and restrained from movement in any direction.
- The positive terminals should be protected by a cover or boots.
- Refer to ABYC standards for more installation guidelines.

PARALLEL INSTALLATION (Only a maximum of 4 parallel strings Allowed . (Capacity adds up / string)

Ensure proper uniform current distribution with equal resistance cables on both sides of the Battery Terminals that are connected to common load/ charger bus bars. No center or end tappings are allowed as it would cause differential drain on batteries in the battery bank.



SERIES INSTALLATION (System voltage increases by connecting batteries in series)



CONNECTING THE BATTERY

- Take care not to short circuit the terminals on the battery. Use insulated tools.
- 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 have 3/8-16 UNC stud and should be torqued to 16 ft lbs (21.69 nm).

OPERATION & CHARGING

- Firefly batteries can be operated in a partial state of charge for longer periods of time without sustaining any permanent damage. Depending on state of charge, the backup duration will increase / decrease. Recovery charge to fully charge the battery can be given once in 15/30 days for continuous cycling duty usage as backup duration drops considerably with cyclic usage.
- The batteries may emit gas during the first 10-20 charge cycles. This is normal. If liquid is observed leaking from the vent caps (the smaller grey caps on the top of the battery), wipe clean with rubbing alcohol and tighten the valve cap to 1-3Nm (0.75-2.2ft-lbs.) (1.01-2.98nm) If leaking persists, you may remove the plugs, wash with water, dry with compressed air and fit it back immediately.
- **Max discharge Current:** The maximum recommended discharge current is 0.7C Amps for extended periods of time to ensure the longevity of the battery. The firefly battery can discharge up to 3C for short periods.
- **Max Charge Current:** The max recommended continuous charge rate is 0.5C but 1C can be

tolerated for sporadic charge sessions. Frequently charging at 0.4C to 1C will negatively impact the battery's lifetime.

- **Peukerts Constant:** 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 firefly 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.
- **Temperature Compensation:** If you have hardware that allows the user to enter a temperature coefficient, use 8mV/C° for temperature compensation for a L-16 (4V450Ah) battery in series & 24mV/ C° for a 24V battery. Contact us for higher voltages. The temperature compensation should be zero at an ambient temperature of 25°C/77°F. This means that for every degree the battery is ABOVE 25°C/77°F, the charge V should be reduced by 8mV per L-16(4V450Ah) battery in series. For every degree that the battery is BELOW 25°C/77°F, the charge voltage should be increased by 8mV per L-16(4V450Ah) battery in series.
- **Note:** That with Firefly batteries, the battery temperature sensor needs to be fixed to the Neg. Terminal or on the length side Centre of the batteries at 1/3 height.

Charge V Settings

- **Bulk Phase:** Charge Firefly batteries @ 4.70V per L-16(4V450Ah) battery in series with temperature compensation till battery reaches 4.70V per L-16(4V450Ah) battery in series. Current limit at 0.1C to 0.5C Amps maximum.
- **Absorption phase:** switch over to charging @ 4.60V per L-16 (4V450Ah) battery in series until the charging current drops to around 1A with the set current limit.
- **Float-Charging**: Firefly batteries do not require a float charge on a regular basis. However, if you are float charging, due to their longer projected lifespan, it is important to keep the float voltage at 4.50V per L-16 (4V450Ah) battery in series to ensure the battery lasts for as many cycles as possible for shorter durations (6 to 8 hours).
- **Reset to bulk phase**: for programmable charging sources, adjust the "reset to bulk phase" to occur if the battery voltage drops below 4V per L-16(4V450Ah) battery in series.
- **Periodic Fast & Complete Recovery Charge Cycle Recommendations**: Note that periodic fast (high current) charging from a low state of charge can help restore usable capacity after periods of repeated slow charging (less than 0.2C) or deep discharge cycles.
  It is recommended that the battery goes through a complete charge cycle from a low state of charge every week if they are being heavily cycled or at minimum every 30 days.
  Ideally the batteries will be charged at a current of 0.3C Amps but a minimum of 02C (90A per string of L-16(4V450Ah) battery) is acceptable. These charge cycles should end with a 24hour float charge at 4.50V. For applications lacking fast charging capability, you may use 0.1C Amps current limit (45 Amps for L-16 (4V450Ah). This will take longer time to fully charge .
- **Operating Temperature:** 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. At subzero ambient at CCCV charging, reduce the limit current to 0.1C Amps instead of 0.4C rate charging for prolonged duration.

THE POWER OF CARBON FOAM

General Ready Reckoner for charger voltage & Current settings

For Initial Charging before commissioing / cycling / Recovery Charging after every 30 cycles)			
CCCY (Constant Current_ Constant Voltage) Chargers with Temperature Compensation			
Note : Temperature Sensor shall be fixed to Battery Terminals only.			
All the chargers to be used shall be with Automatic Temperature compensation type with sensors			
Chargers without Temperature compensation shall not be used. If used , warranty will be void.			
Charger Voltage_Boost/Bulk mode	2.35 V	Per cell	in series till 2.35 VPC is reached_CC mode
Current limit to reach 2.35V/cell	0.5C A	Maximum	(0.2C A ~ 0.3C A Preferable)
Charger Voltage Absorption mode	2.30 V	Per Cell	(6 hours Maximum) _Switch to CV mode
Charger Voltage Float/ mode	2.25 V	Per Cell	(6 hours Maximum)_Switch to CV mode

Recommended duration in hours to be set for programmable chargers.

Charging with Programmable Chargers (Recommended duration in hours)											
Note : * Vpc is voltage Per Cell in Series & * C is Battery capacity OR Battery Bank Capacity Ah @C20											
Charging Phases ---------->	Bulk Charging Phase @2.35Vpc (hrs)					Absorption Charging Phase @2.30Vpc (hrs)					Float
Charge rate Current Limi-->	0.1C A	0.2C A	0.3C A	0.4C A	0.5C A	0.1C A	0.2C A	0.3C A	0.4C A	0.5C A	@2.25 Vpc
Depth of Dischage %											
10%	0 .	0 .	0 .	0 .	0 .	1.00	0.5 .	0.25 .	0.25 .	0.25 .	Max. 6 .
20%	0.50	0.50	0.50	0.25 .	0.25 .	1.00	0.5 .	0.50	0.25 .	0.25 .	Max. 6 .
30%	1.00	0.50	0.50	0.25 .	0.25 .	1.00	0.5 .	0.50	0.50	0.50	Max. 6 .
40%	2.00	1.00	0.50	0.25 .	0.25 .	2.00	0.5 .	0.50	0.50	0.50	Max. 6 .
50%	3.00	1.50	1.00	0.50	0.50	3.00	0.5 .	0.50	0.50	0.50	Max. 6 .
60%	4.00	2.00	1.50	1.00	0.50	4.00	1.00	0.50	0.50	0.50	Max. 6 .
70%	5.00	2.50	2.00	1.50	1.00	5.00	2.00	1.00	0.50	0.50	Max. 6 .
80%	6.00	3.00	2.50	2.00	1.50	6.00	3.00	2.00	0.50	0.50	Max. 6 .
Note : Higher rate of charging reduces service life and requires hogher cost chargers.											

SAFETY

For any operation on the batteries, from storage to recycling, the following safety rules should be observed:

- Do not smoke.
- Use tools with insulated handles to tighten connections.
- Check that the connections between the cells / mono blocs are fitted correctly.
- Never place tools on the batteries (metal tools are particularly dangerous).
- Never lift the cells / mono blocs at the terminals.
- Never use a synthetic cloth or sponge to clean the cells /mono blocs.
- Use water (wet cloth) without additives.
- Avoid shocks.
- Even when disconnected, a battery remains charged.
- Always wear insulating gloves and glasses while handling batteries.
- Read the “Installation Instruction” and “Operating Instruction” carefully.

EMERGENCY 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. Seek medical attention immediately.

PRECAUTIONS FOR SAFEHANDLING 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

D.O.T. REGULATIONS-NONSPILLABLE
Firefly Batteries Group 31M 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

The maximum storage time at 20°C/68°F is 15 months. The maximum storage time at 30°C/86°F is 8 months. The maximum storage time at 40°C/104°F is 3 ~ 4 months.

Higher temperatures cause higher self-discharge and shorter storage time between recharging operations.

For extended storage periods it is recommended to check the „open circuit voltage in the following intervals:

Storage at 20°C/68°F: Check Open circuit voltage after a storage period of 12 months, then every 3 months afterwards.

Storage at 30°C/86°F: After a storage period of 6 months, then every 2 months afterwards.

Storage at 40°C/104°F and above: After a storage period of 3 months, then every 1 months afterwards.

FULLY-CHARGED WHEN SHIPPED

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

STORAGE CONDITIONS - In the user’s interest, the storage period should be as short as possible.

- The temperature has an impact on the self-discharge rate and hence, it is important to store the

batteries in a fully charged condition in a cool but frost-free room.

- The preferred storage temperature range is + 5°C/41°F to 20°C/68°F if storage room can be conditioned. If stored sub-zero, it must be stored in a charged/above semi-charged state.
- Storage on a pallet wrapped in plastic material is authorized. It is not recommended however in rooms where the temperature fluctuates significantly, or if high relative humidity can cause condensation under the plastic cover.
- With time, this condensation can cause a whitish hydration on the poles and lead to high self-discharge by leakage current. This hydration has no effect on the battery operation or service life if no corrosion occurs. It is forbidden to stack one pallet above the other.
- Avoid storing unpacked cells / mono blocs on sharp-edged supports. It is recommended to have the same storage conditions within a batch, pallet or room.
- The storage location should provide the following functions:
- Shelter the cells / mono blocs from harsh weather and risk of flooding.
- Protect the batteries against any overheating risk induced by direct exposure to the sun radiation or by their amplification through glass walls.
- Protect the batteries from any risk of electric shock resulting from short circuiting by a conductive object or from a building up of conductive dust.
- Avoid any risk of mechanical shock caused by dropping objects onto the cell / mono bloc or by dropping the cell / mono bloc itself.

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.