

# FULBAT®

## STARTER BATTERY

### GEL & LITHIUM BATTERY

Charging & maintaining instruction guide

#### DISCLAIMER

The following recommendations do not replace the regulations and standards applicable in individual countries, which should take precedence at all times.

The purpose of this document is to help you consider how best to set up a (non-industrial) charging room to be used by distributors of FULBAT products so that the charge in GEL/SLA and LITHIUM batteries can be maintained (where they are not installed in an appliance and are intended for resale). With this in mind, it's advisable to contact the authorities in your country, to obtain expert advice, and to consult your insurer to ensure that the charging room is in compliance with all applicable regulations.

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## 1 Technical concepts and general product characteristics

### 1.1 General and specific characteristics of GEL/SLA & Lithium batteries

- GEL/SLA battery range is sealed, factory-activated with a valve regulation (vent).
- This valve allows some of the gases produced during use to be reabsorbed inside the battery, which removes the need for any maintenance (no water added).
- As the battery is sealed, there is no risk of any spillage.
- As the battery is activated at the factory, it is important to ensure the battery voltage remains at 12.4 V or higher for storage and at least 12.7 V when offered for sale. This will allow the retailer to store the battery for a few months without having to charge it.
- GEL/SLA batteries must be charged using a suitable charger to prevent the battery from degrading prematurely and to stop accumulated hydrogen from being released.
- LITHIUM batteries voltage must remain at 12.8V or higher for storage and at least 13 V when offered for sale. This will allow the retailer to store the battery for a few months without having to charge it. These batteries must be charged using a LiFePO<sub>4</sub> suitable charger (or lead acid charger without desulfation step).

### 1.2 Precautions to be taken when using batteries

- The battery casing must not be broken under any circumstances.
- Never obstruct the battery valve (for GEL/SLA).
- Once the battery has been charged, all necessary precautions must be taken during storage and handling to avoid any risk of a short-circuit.
- For GEL/SLA battery = Use a charger suitable for motorcycle batteries and with a charging current between C10 and C3 (corresponding to 10% and 33% of the battery capacity)
- For LITHIUM battery: Use a charger suitable for Lithium batteries with a max charging current of 1C (corresponding to 100% of the battery capacity). A faster charge with 2C max current is possible but must not exceed 30 minutes. The charging voltage should never be higher than 15V. If the battery seems hot when touching, stop charging.

- Allow the battery to stabilise after charging (for 2 to 3 days). If you have to test the battery just after charging, wait at least 2 hours before doing so, and ensure that =
  - o GEL/SLA battery voltage is greater than or equal to 13V
  - o Lithium battery voltage is greater than or equal to 13.4V
- Temperature and humidity can have a significant effect on a battery's discharge rate, and hence on how often it has to be re-charged. Batteries should be stored at temperatures between 10°C and 25°C, and the temperature during storage must not exceed 40°C. Humidity during storage should ideally be between 40% and 60%.

### **1.3 Risks description**

It is important that individuals responsible for charging the batteries are made aware of the associated risks so that they can take the necessary precautions.

The risks associated with charging the batteries are as follows:

- Risk of explosion and fire (hydrogen may be released during charging)
- Risk of poisoning (related to the presence of lead and acid in the batteries)
- Risk of respiratory tract irritation (related to the presence of acid in the batteries)
- Risk of electric shock (associated with electrical equipment and batteries that are already charged)
- Risk of chemical burns (related to the presence of acid in the batteries)
- Risk of musculo-skeletal disorders (due to the weight of the batteries and repetitive movements).

## **2 Precautions**

### **2.1 In the charging room**

- Set aside a dedicated space for charging the batteries. If possible, separate this space from the storage area using a fire door.
- The space should be clearly marked and delimited. Access to the room should be limited to suitably qualified individuals only.
- The electrical installation should comply with all applicable standards and be certified by a suitably qualified professional.
- Do not exceed the maximum number of chargers the electrical installation can support.



- The room should be equipped with a fire extinguisher and a fire alarm system (detectors)
- Prepare a solution of sodium bicarbonate (0.1 kg/l or 1 lb/gal) to neutralise any electrolyte leaks.
- Ventilation openings should ventilate a sufficiently large area (at least 2% of the floor area). Otherwise, use a suitable mechanical ventilation system. The room should be equipped with an air inlet low down in the room and a high-level outlet. Both should provide a sufficient flow rate.
- Ensure that there are no areas high up in the room where gas (in this case hydrogen) might accumulate.
- The room should be filled with fresh air between charges.
- So-called 'intelligent' chargers (type Fulload 1000, Fulload F4) should be used if possible. They should be equipped with various protective features (such as polarity reversal, short-circuit protection, automatic start when connecting and automatic stop when the battery is fully charged).
- Do not allow any conductive objects to come into contact with the battery terminals.
- Do not allow any metal objects to be placed on top of the battery, as this may cause a short circuit.
- Ensure that all metal equipment used (e.g. hoists, metal shelves) is earthed and insulated using plastic.
- Use spark arrestors.
- Make sure that the shelves used to support the batteries are made of non-conductive materials. If this is not possible, make sure the shelves used are coated with an insulating substance (plastic or rigid cardboard) to prevent sparks from being generated.

## 2.2 Individuals handling batteries

Batteries are considered dangerous products. Any individuals charging or maintaining them must be suitably trained and wear electrically insulated gloves, safety boots or shoes, and safety goggles.

It is strongly recommended:

- to not wear clothes made of nylon, as such clothing tends to accumulate static electricity and may cause sparks;
- to prevent individuals from smoking in the charging room or wearing jewellery while handling batteries.
- to ensure that eyewash and/or an emergency shower is available in the immediate vicinity of the charging room.

## 3 Typical installation example

### 3.1 Rack Description

Given the weight of the batteries, we recommend the use of specific table or pallet racking.

The batteries should be stored on first level, one at 90 cm off the ground, and two rows.

The master carton should be stored on the second level.

In this example, we have used the following materials:

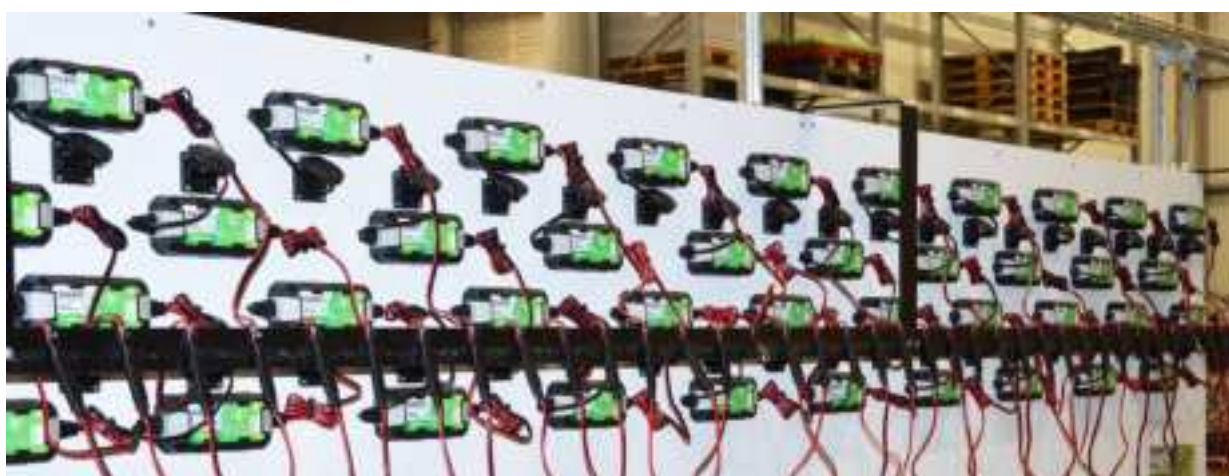
- For the 1st floor of medium density fiberboard : 350 cm x 45 cm x 1.8 cm.
- For the 2nd floor of medium density fiberboard : 350 cm x 90 cm x 1.8 cm.
- The metal structure of the table must be able to withstand a minimum weight of 1.2 tons



Photo: Example Electric outlet use



Example FULLOAD F4 fixed :



## 3.2 FULBAT Chargers description

### 3.2.1 FULLOAD 1000 charger short description (For Lead acid & Lithium)



FULLOAD 1000 chargers are designed to charge **6V or 12V** GEL/SLA batteries with capacities from **2 Ah to 10 Ah** and for **12V** Lithium batteries with capacities between **2 Ah** and **10 Ah**



The FULLOAD 1000 charger has a maximum output current of 1A.

The charger's operating temperature range is **0°C – 45°C**

The input mains voltage range is 220 – 240 VAC, frequency 50Hz, **0.35 A**.

When using chargers on a table, it is recommended to store a maximum of 40 FULLOAD 1000 chargers on each side, with 20 chargers by level.

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The electrical connections should comply with all applicable standards and be certified by a suitably qualified professional.

NB: FULLOAD 1000 chargers are designed to be connected directly to the power supply and are not supplied with a power cable. Ideally, high-level trunking should therefore be fitted for the racks.

### 3.2.2 FULLOAD F4 charger short description (For Lead acid & Lithium)



FULLOAD F4 chargers are designed to charge **6V or 12V** GEL/SLA batteries with capacities between **6Ah** and **40Ah** and for Lithium batteries with capacities between **3Ah** and **30Ah**

The FULLOAD F4 charger has a selectable output current = 2A or 4A

The charger's operating temperature range is **0°C – 40°C**

The input mains voltage range is 220 – 240 V AC, frequency 50Hz, **0.8 A**.

When using chargers on a rack, it is recommended to store a maximum of 40 FULLOAD F4 chargers on each side, with 20 chargers by level.

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The electrical connections should comply with all applicable standards and be certified by a suitably qualified professional.

## 4 Managing battery stocks and planning charges recommendation

### 4.1.1 Managing battery stocks recommendation.

We recommend a combination of FIFO and batch-based stock management to help you monitor charging dates (some software programs allow you to calculate expiry dates) and storage periods.

### 4.1.2 How frequently should GEL/SLA & Lithium batteries be charged

GEL/SLA & Lithium batteries have to be charged periodically as part of normal maintenance. The period between charges varies according to the size of the battery (see the table in Section 6 of the annex). As a guide, and **provided batteries are stored under normal conditions** they should be charged as follows:

- GEL/SLA batteries with capacities of less than 4Ah should be charged every 3 months.
- GEL/SLA batteries with capacities between 4Ah and 12Ah should be charged every 4 months
- GEL/SLA batteries with capacities between 12Ah and 14Ah should be charged every 5 months
- GEL/SLA batteries with capacities between 14Ah and 30Ah should be charged every 6 months.
- LITHIUM batteries should be charged every 6 months.

As temperature and humidity can reduce the period between charges, it is recommended to check them and adjust the charging intervals according to the environment in which the batteries are stored.

#### **Example:**

If we take a battery with a capacity of 8 Ah that is designed to be re-charged every 4 months, and if we assume it was charged in January, the next charge should be planned for May.

#### 4.1.2.1 Calculating charging time

The theoretical charging time can be calculated by dividing the battery capacity by the charger's output.

Example:

- If the GEL/SLA battery capacity is 6Ah and the charger used is Fulload 1000 (1A output), the charge duration will be  $6 \div 1 = 1$  hour.
- If the GEL/SLA battery capacity is 20Ah and the charger is Fulload F4 (rated at 4A output) the duration will be  $20 \div 4 = 5$  hours.
- If the Lithium battery capacity is 2Ah and the charger used is FULLOAD 1000 (1A output), the charge duration will be  $2 \div 1 = 2$  hours.

This time corresponds to the theoretical charging time for a full charge; the time required for regular maintenance charges will be shorter

#### 4.1.2.2 Charging cycles.

The number of charging cycles that can be completed per day depends on the following factors:

- The manpower available to install, charge and recondition batteries.
- The number of chargers in the charging room.
- The capacity of the batteries to be charged, the bigger the battery, the longer the charge.
- The number of batteries to be charged.

A maximum of three charging rotations can be performed in a single charging room – 2 short rotations of 5hrs and one overnight rotation. For Lithium battery, you can increase battery rotation to 3 or 4 per day as the charge is faster than lead acid battery.

However, we recommend you carry out 2 rotations in the morning and one overnight. This is because carrying out 3 rotations allow a continuous working (i.e. staff dedicated to charging the batteries).

Batteries with a theoretical charging time of up to 5 hours can be charged in short rotations. Batteries with longer charging times should be charged at night.

#### 4.1.2.3 Planning charges

You should aim to carry out one charge every morning and one in the evening.

If there are more short charges than night charges, you can carry out two short charges, one in the morning and one in the evening.

FULLLOAD F4 & FULLLOAD 1000 chargers – these chargers switch to maintenance charging as soon as the battery is charged.

Priority should be given to charging those batteries for which demand is currently highest.

## 5 Checks and suggested operating procedure for charges

Whether batteries are being charged or taken off charge, any individuals charging or maintaining them must be suitably trained and wear electrically insulated gloves, safety boots or shoes and safety goggles.

It is strongly recommended:

- not to wear clothes made of nylon, as such clothing tends to accumulate static electricity and may cause sparks;
- to prevent individuals from smoking in the charging room or wearing jewellery while handling batteries;
- to ensure that eyewash and/or an emergency shower is available in the immediate vicinity of the charging room.

#### 5.1.1 Putting batteries on charge

##### Check 1: Check you have the right batteries



Check the batch number and item references against the charging schedule



Check the charge rotation (morning or evening)





If a pallet has to be unpacked, keep the label for re-palletisation.

### Check 2: Precautions to be taken when opening the master carton



If the master carton is dusty, remove the dust so as to prevent the color box from becoming dirty.



Be careful not to damage the color box when opening the master carton with the cutter

### Check 3: Check the charging room



Check that the room is suitably ventilated and that the temperature is within the operating range (between 0°C and 40°C).

### Check 4: Make sure the batteries are positioned in a way that maintains traceability



Put batteries from the same lot on charge one after the other.

The last battery in the batch should be positioned at right angles to the others to mark the end of the batch.



Use the plastic tab to remove the first color box and store it in the master carton until you repack it.



Do not take the color box out by pulling the top, as it could tear.



Open the color box, taking care not to tear the cover



Pay attention to the leaflet, nuts and bolts and insulating cover(s), all of which will have to be replaced after charging.

**Check 5: Check the charger to be used and make sure it is working properly**

Check the charger to be used, as shown on the charging schedule (FULLOAD F4, FULLOAD 1000).

The **FULLOAD 1000** charger is recommended for lead acid batteries with capacities **from 2Ah up to 10Ah** and for Lithium batteries **from 2Ah up to 10Ah**.

The **FULLOAD F4** charger is recommended for lead-acid batteries with capacities **from 6Ah up to 40Ah** and for Lithium batteries **from 2Ah up to 40Ah**.

**For your own safety and to prevent damage to the batteries, it is very important to use the right charger.**



Connect the charger clamps to the battery terminals, paying particular attention to the polarity of the battery.



Check the charger lights to ensure that the charger is working properly (refer to the charger information sheet).



If a charger is found to be defective, disconnect the power supply from the charger and wrap the cables around the charger so that it can no longer be used. Inform the individual responsible for maintaining the charger so the charger can be replaced as soon as possible.



Once all the batteries in the same batch have been put on charge, enter the charge start time in the log.

**Check 6: Check the whole charging room**

Once all the batteries to be charged have been connected to their chargers, inspect all the chargers to ensure that they are properly connected and working correctly.

### 5.1.2 Procedure for removing batteries from charge.

#### Check 7: Check before disconnecting the battery



Check the charging schedule to make sure that the minimum charging time has elapsed.

#### Check 8: Precautions to take when disconnecting the charger



Check that the charger light is showing a full charge (100% LED lights). If not, check the information sheet for the charger concerned to find out why.



Disconnect the clips from the battery charger and replace the insulating cover(s) on the battery terminal(s). Make sure you observe the correct color coding for polarities (red, black).



Check that the bag containing the nuts and bolts is correctly positioned and is not preventing the color box from being closed.



Replace the leaflet correctly inside the color box.



Close the color box and check the overall condition of the color box.



Once all the batteries have been disconnected, enter the end time for the charge in the log.

**If the color box is damaged or incomplete, notify the relevant member of staff.**

#### Check 9: Precautions to be taken when replacing the color box in the master carton



Put the color boxes inside the master carton. Make sure they are all the same way up.



Replace the removal tab around a color box.



Close the master carton using **transparent sticky tape**.

#### Check 10: Precautions for palletisation



Change the pallet if it is damaged.



Follow the initial palletising plan (number of master cartons per level, number of levels, whether it is staggered or not, etc.).



Check that the batch label is correctly attached and that the number of batteries is the same as the number that were on the pallet when it entered the charging room.



For batteries not packed in color boxes, remember to put the nuts and bolts back on the pallet and to position the spacers correctly between the levels.

#### Check 11: Return batteries to the 'Charged batteries for stock' zone.



Cover the pallet in film. Replace any protective covers and the cardboard or wooden lid wherever possible.



## 6 Attachment

### 6.1 12V GEL BATTERY Technical Charging Data Reference Guide

P/N	Fulbat Designation	Voltage (V)	Capacity Ah (10H-R)	Capacity Ah (20H-R)	Charger output current (A)	Estimated charging Time (Hr)	Maximum charging frequency for sale (in month)	Maximum charging frequency for stock (in month)	Fulbat Recommended charger
550980	12N5.5-3B GEL	12	5,5	5,8	1	5,80	4	5	Fulload 1000
550981	12N5.5-4A GEL	12	5,5	5,8	1	5,80	4	5	Fulload 1000
550842	FB3L-A/B GEL	12	3	3,2	1	3,20	3	4	Fulload 1000
550916	FB4L-B GEL	12	5	5,3	1	5,30	4	5	Fulload 1000
550991	FB5L-B GEL	12	5	5,3	1	5,30	4	5	Fulload 1000
550992	FB7-A GEL	12	8	8,4	2	4,20	4	5	Fulload F4
550989	FB7C-A GEL	12	8	8,4	2	4,20	4	5	Fulload F4
550995	FB7L-B/B2 GEL	12	8	8,4	2	4,20	4	5	Fulload F4
550925	FB9-B GEL (12N9-4B-1)	12	9	9,5	2	4,75	4	5	Fulload F4
550956	FB10L-A2/B2 GEL	12	11	11,6	2	5,80	4	5	Fulload F4
550947	FB12A-A/B GEL (12N12A-4A-1)	12	12	12,6	4	3,15	5	6	Fulload F4
550926	FB12AL-A2 GEL	12	12	12,6	4	3,15	5	6	Fulload F4
550971	FB14A-A2 GEL	12	14	14,7	4	3,68	6	7	Fulload F4
550948	FB16AL-A2 GEL	12	16	16,8	4	4,20	6	7	Fulload F4
550979	FB16CL-B GEL	12	19	20	4	5,00	6	7	Fulload F4
550949	FT4B-BS GEL	12	2,3	2,4	1	2,40	3	4	Fulload 1000
550950	FTR4A-BS GEL	12	2,3	2,4	1	2,40	3	4	Fulload 1000
550671	FTX4L-BS / FTZ5S GEL (High Capacity)	12	5	5,3	1	5,30	4	5	Fulload 1000
550919	FTX5L-BS / FTZ6S GEL	12	5	5,3	1	5,30	4	5	Fulload 1000
550963	FTX6,5L-BS GEL	12	6,8	6,5	2	3,25	4	5	Fulload F4
550920	FTX7L-BS GEL	12	6	6,3	2	3,15	4	5	Fulload F4
550915	FTX7A-BS GEL	12	6	6,3	2	3,15	4	5	Fulload F4
550921	FTX9-BS GEL	12	8	8,4	2	4,20	4	5	Fulload F4
550922	FTX12-BS GEL	12	10	10,5	2	5,25	4	5	Fulload F4
550679	FT12A-BS GEL	12	10	10,5	2	5,25	4	5	Fulload F4
550923	FTX14-BS GEL	12	12	12,6	2	6,30	5	6	Fulload F4
550990	FTX14L-BS GEL	12	12	12,6	4	3,15	5	6	Fulload F4
550927	FTX14AHL-BS / FB14L-A2/B2 GEL	12	14	14,7	4	3,68	6	7	Fulload F4
550946	FTX14AH-BS / FB14-A2/B2 GEL	12	14	14,7	4	3,68	6	7	Fulload F4
550763	FTX16 GEL	12	14	14,7	4	3,68	6	7	Fulload F4
550993	FTX20-BS GEL	12	18	18,9	4	4,73	6	7	Fulload F4
550994	FTX20A-BS GEL	12	18	18,9	4	4,73	6	7	Fulload F4
550924	FTX20HL-BS GEL	12	18	18,9	4	4,73	6	7	Fulload F4
550982	FTX24HL-BS / F50-N18L-A/A2/A3 GEL	12	21	22,1	4	5,53	6	7	Fulload F4
550943	FIX30L-BS GEL	12	30	31,6	4	7,90	6	7	Fulload F4
550635	FTZ7S GEL	12	6	6,3	2	3,15	4	5	Fulload F4
550641	FT7B-4 GEL	12	6,5	6,8	2	3,40	4	5	Fulload F4
550998	FTZ7V GEL	12	6,5	6,8	2	3,40	4	5	Fulload F4
550918	FTZ8V GEL	12	7	7,4	2	3,70	4	5	Fulload F4
550642	FT9B-4 GEL	12	8	8,4	2	4,20	4	5	Fulload F4
550636	FTZ10S GEL	12	8,6	9,1	2	4,55	4	5	Fulload F4
550637	FTZ12S GEL	12	11	11,6	2	5,80	4	5	Fulload F4
550999	FT12-10Z GEL	12	8,6	9,1	2	4,55	4	5	Fulload F4
550643	FT12B-4 GEL	12	10	10,5	2	5,25	4	5	Fulload F4
550638	FTZ14S GEL	12	11,2	11,8	2	5,90	4	5	Fulload F4
550644	FT14B-4 GEL	12	12	12,6	4	3,15	5	6	Fulload F4
550917	NH12-20 GEL (BMW)	12	20	21,1	4	5,28	6	7	Fulload F4
550945	53030 GEL (F60-N30L-A)	12	30	31,6	4	7,90	6	7	Fulload F4
550843	53034 GEL	12	30	31,6	4	7,90	6	7	Fulload F4
550880	FHD14HL-BS GEL (Harley.D)	12	14	14,7	4	3,68	6	7	Fulload F4
550881	FHD20HL-BS GEL (Harley.D)	12	20	21,1	4	5,28	6	7	Fulload F4
550882	FHD30HL-BS GEL (Harley.D)	12	30	31,6	4	7,90	6	7	Fulload F4

## 6.2 6V GEL/SLA BATTERY Technical Charging Data Reference Guide

P/N	Fulbat Designation	Voltage (V)	Capacity Ah (10H-R)	Capacity Ah (20H-R)	Charger output current (A)	Estimated charging Time (Hr)	Maximum charging frequency for sale (in month)	Maximum charging frequency for stock (in month)	Fulbat Recommended charger
550959	6N4-2A/A-4 GEL	6	4	4,2	1	4,20	3	4	Fulload 1000
550960	6N6-3B/B-1 GEL	6	6	6,3	1	6,30	3	4	Fulload 1000
550961	B49-6 GEL	6	10	10,5	1	10,50	3	4	Fulload 1000
550962	B38-6A GEL	6	13	13,7	4	3,43	3	4	Fulload F4
550957	6N11A-1B/3A GEL	6	11	11,6	1	11,60	3	4	Fulload 1000
550958	6N11A-4A GEL	6	11	11,6	1	11,60	3	4	Fulload 1000

## 6.3 12V SLA BATTERY Technical Charging Data Reference Guide

P/N	Fulbat Designation	Voltage (V)	Capacity Ah (10H-R)	Capacity Ah (20H-R)	Charger output current (A)	Estimated charging Time (Hr)	Maximum charging frequency for sale (in month)	Maximum charging frequency for stock (in month)	Fulbat Recommended charger
550901	U1-9 SLA (12N24-4A)	12	-	28	4	7,00	6	7	Fulload F4
550902	U1R-9 SLA (12N24-3A)	12	-	28	4	7,00	6	7	Fulload F4
550903	U1-12 SLA (12N24-4A)	12	-	32	4	8,00	6	7	Fulload F4
550904	U1R-12 SLA (12N24-3A)	12	-	32	4	8,00	6	7	Fulload F4
550633	SLA12-18	12	18	18,9	4	4,73	6	7	Fulload F4
550879	SLA12-20	12	20	21,1	4	5,28	6	7	Fulload F4
550907	SLA12-22	12	22	23,1	4	5,78	6	7	Fulload F4

## 6.4 Lithium BATTERY Technical Charging Data Reference Guide

P/N	Fulbat Designation	Voltage (V)	Capacity Ah (10H-R)	Capacity Ah (20H-R)	Charger output current (A)	Estimated charging Time (Hr)	Maximum charging frequency for sale (in month)	Maximum charging frequency for stock (in month)	Fulbat Recommended charger
560501	FLTK01	12,8	2	-	1	2,00	5	6	Fulload 1000
560635	FLTX4L/5L/7L - FLTZ5S/6S/7S	12,8	2	-	2	1,00	5	6	Fulload F4
560636	FLTX4L/5L/7L+ - FLTZ5S/6S/7S+	12,8	3	-	2	1,50	5	6	Fulload F4
560624	FLT7B/9B	12,8	4	-	4	1,00	5	6	Fulload F4
560625	FLTX7A/9/12/14 - FTZ10S/12S/14S	12,8	5	-	4	1,25	5	6	Fulload F4
560633	FLTX7A/9 - FTZ10S	12,8	3	-	2	1,50	5	6	Fulload F4
560634	FLTX12/14 - FTZ12S/14S	12,8	8	-	4	2,00	5	6	Fulload F4
560626	FLT12B/14B	12,8	6	-	4	1,50	5	6	Fulload F4
560627	FLTX20HL	12,8	12	-	4	3,00	5	6	Fulload F4
560628	FLTX20H	12,8	12	-	4	3,00	5	6	Fulload F4
560629	FLTX30HL	12,8	18	-	4	4,50	5	6	Fulload F4