



## FAQ Mastervolt Lithium Ion batteries

### 1. What is the chemistry/material definition?

The Mastervolt Lithium Ion batteries are based on Lithium Iron Phosphate. These batteries are having a 3 times higher energy density compared to Lead Acid batteries. Other Lithium variants are Lithium Polymer, Lithium Cobalt Oxide and Lithium Manganese Oxide with an even higher energy density but the general opinion is that an increase of power density has a negative influence on safety. The Lithium Iron Phosphate battery of Mastervolt is considered as the safest Lithium based battery.



### 2. How safe is the MLI battery from Mastervolt and what are the safety issues?

Lithium Iron Phosphate is considered the safest Lithium based battery available. Additionally Mastervolt has integrated a unique battery management system with Bi-directional Active Cell Management (BAC). This BAC system manages Voltage, Current and Temperature in order to keep the battery in a safe working area under all conditions. The battery is equipped with a MasterBus communication port (CAN based) controlling the external system components (e.g. battery charger, battery disconnect switch) to create a redundant safety system and increase safety even further.

### 3. Do the batteries need Cell Balancing?

No, Mastervolt has integrated Cell Balancing in the battery as a standard. This is to equalize differences between the various cells and protects cells for overcharging. This is very important to prevent the battery undesirable situations. A positive effect of the Mastervolt Cell Balancing system is that it increases the performance and extends the life span of the Lithium Ion battery.

### 4. How does the Cell Balancing from Mastervolt work?

The battery management system of Mastervolt with Bidirectional Active Cell Management (BAC) is unique in the world. Ultra efficient electronics transfer any excess of energy from the stronger cells via a 'common rail' to the weaker cells in the battery pack. With the BAC system no energy will be lost or converted into heat but instead it will be used to charge the battery exactly as you want it. This occurs not only during charging but also during discharging, so not only is the battery kept safe but more capacity will be available.

### 5. Does the Mastervolt Lithium Ion battery require any special handling?

No, the battery itself does not require any special handling. We do prescribe a Mastervolt charge system to enable us to take full responsibility for the battery. This system requires a MasterBus controlled battery charger, a MasterShunt (will be integrated in the future) and a remote controlled battery contactor. With these products integrated we can guarantee a proper and safe system with optimum availability of power and a maximum cycle life for any given application.

### 6. What is the individual cell voltage and capacity?

The Mastervolt Lithium Ion battery consists of 8 high capacity cells of 3.35V each/ 26.8V total. Up to 2008 most Li-Ion batteries consisted of multiple small capacity cells configured both in series and in parallel to create a high capacity battery. This complicates the energy management of each individual cell and most often results in basic measure such as voltage control in stead of true cell management. The Mastervolt BAC system manages Voltage, Current and Temperature of each individual cell in order to deliver best performance.

### 7. Can the Lithium Ion be paralleled to create bigger battery banks?

Yes, due to the integrated BAC system there are no restrictions in paralleling the batteries. Be aware that the rating of the remote controlled battery contactor current is rated to the final current levels.

### 8. Can the Lithium Ion be connected in series to create a high voltage battery?

Yes, due to the integrated BAC system it is possible to connect multiple MLI batteries in series. Mastervolt specifies this can be done up to 10 batteries/ 260V without specific measures. Please contact Mastervolt for applications in the range of 260 to 600V.



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9. Will the batteries support discharge rates of 1C? 1.5C? 2C? 3C?

The commercial specification of the Mastervolt MLI batteries is a maximum discharge rate of 1C with a max peak discharge current of 10C for 5 seconds. Exceeding these limits can result in an unbalance of the internal cells, higher than the BAC system can compensate. If this is a single event it will not be a problem but when it happens more often the capacity (voltage) of the individual cell will divert with a reduction of performance as result.

In case a higher charge or discharge cycle has been performed, it is advised to do the next cycle with lower than advised charge/ discharge current to give the battery time to recover, ie: If you discharge a battery with 2C then charge it afterwards with no more than 50A. If cell variations ever become excessive the Lithium Ion protects itself by disconnecting the battery contactor

10. Will the batteries accept charge rates of 1C? 1.5C? 2C? 3C?

For charging the same rules apply as for discharging, the advised charge current is 0.3C but 1C is allowed. In practice the available AC power or battery charger capacity will more often be the limitation for charging. A standard AC supply of 16A can power a charger to give about 1C of charge current for one MLI 24/160 battery.

Again, if cell variations ever become excessive the Mastervolt Lithium Ion protects itself by disconnecting via the battery contactor.