BS (Battery system)

The lithium iron phosphate (LiFePO4) battery is a type of rechargeable battery, specifically a lithium-ion battery, which uses LiFePO4 as a cathode material, and a graphitic carbon electrode with a metallic current collector grid as the anode. Because of low-cost, low-toxicity, well-defined performance, long-term stability, etc. LiFePO is finding a number of roles in vehicle use and ESS.

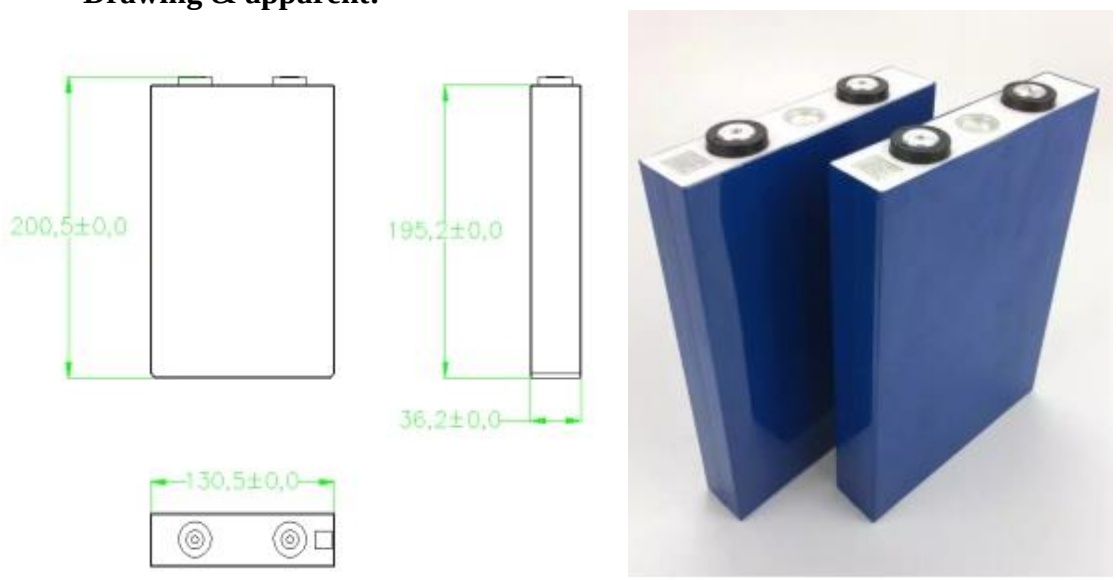
The LiFePO4 battery uses a lithium-ion-derived chemistry and shares many advantages and disadvantages with other lithium-ion battery chemistries. However, there are significant differences.

- LFP chemistry offers a longer cycle life than other lithium-ion approaches.
- Like nickel-based rechargeable batteries (and unlike other lithium ion batteries), LiFePO4 batteries have a very constant discharge voltage.
- Voltage stays close to 3.2 V during discharge until the cell is exhausted. This allows the cell to deliver virtually full power until it is discharged, and it can greatly simplify or even eliminate the need for voltage regulation circuitry.
- Along with the good safety characteristics of LFP batteries, this makes LFP a good potential replacement for lead-acid batteries in many applications such as automotive and solar applications, provided the charging systems are adapted not to damage the LFP cells through excessive charging voltages (beyond 3.6 volts DC per cell while under charge), temperature-based voltage compensation, equalisation attempts or continuous trickle charging.
- The use of phosphates avoids cobalt's cost and environmental concerns, particularly concerns about cobalt entering the environment through improper disposal, as well as the potential for the thermal runaway characteristic of cobalt-content rechargeable lithium cells manifesting itself.
- LiFePO4 has higher current or peak-power ratings
- LiFePO4 cells experience a slower rate of capacity loss (aka greater calendar-life) than lithium-ion battery chemistries.
- One important advantage over other lithium-ion chemistries is thermal and chemical stability, which improves battery safety.
- LiFePO4 is an intrinsically safer cathode material than LiCoO2 and manganese spinel, though omission of the cobalt, with its negative resistance versus

- increasing-heat property potentially encouraging thermal runaway.
- The Fe–P–O bond is stronger than the Co–O bond, so that when abused, (short-circuited, overheated, etc.) the oxygen atoms are much harder to remove. This stabilization of the redox energies also helps fast ion migration.
- As lithium migrates out of the cathode in a LiCoO2 cell, the CoO2 undergoes non-linear expansion that affects the structural integrity of the cell. The fully lithiated and unlithiated states of LiFePO4 are structurally similar which means that LiFePO4 cells are more structurally stable than LiCoO2 cells.
- No lithium remains in the cathode of a fully charged LiFePO4 cell.

- **Battery cell:**

Model: LF90
Description: LFP High-Capacity Li-ion Battery with aluminium shell.
Drawing & apparent:

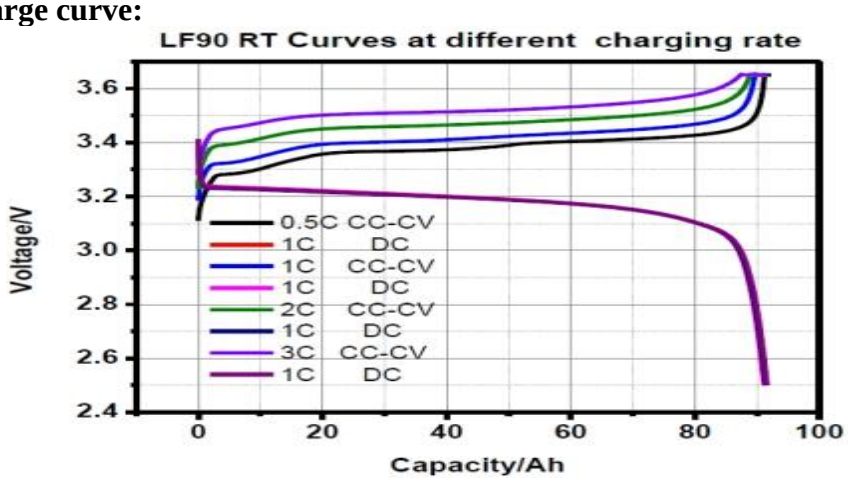


Cell parameter:

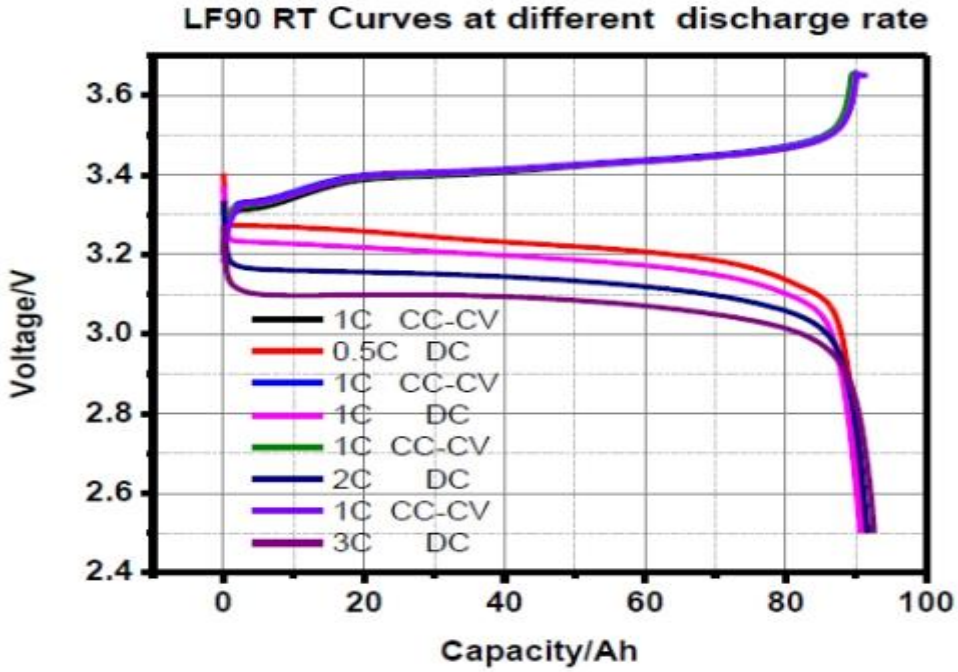
Item		**Parameter**	**Remark**
Cell Performance	Battery Type	lithium iron phosphate	
	Battery Model	LF90	
	Single voltage/capacity	3.2V/90Ah	

Single voltage range	2.5V～3.65V	
Max charge current	1CA	CC-CV
Charge cut-off voltage	3.65V	
Max discharge current	3CA	
Discharge cut-off voltage	2.5V	
Standard charge time	2.5h	
Quick charge time	1.0h	
Recommended SOC	10%~90%	
Charge temp.	0℃~45℃	During charge battery temp. and environment temp. should not exceed 45℃
Discharge temp.	-20℃~55℃	Battery can work at specified temperature range with capacity loss in tolerance
Storage temperature	-20℃~45℃ for one month	
	0℃~35℃ for one year	
Storage Humidity	＜70%	
Width	130.5±0.5mm	
Thickness	36.5±0.5mm	
Height(Total)	200.5±0.5mm	
Height（Main）	195.5±1.0mm	
A column center distance	67.5±1.0mm	
Single weight	1915±30g	
Internal resistance	≤0.6mΩ	30%SOC, AC 1kHz
Specific energy	144Wh/kg	

Charge curve:

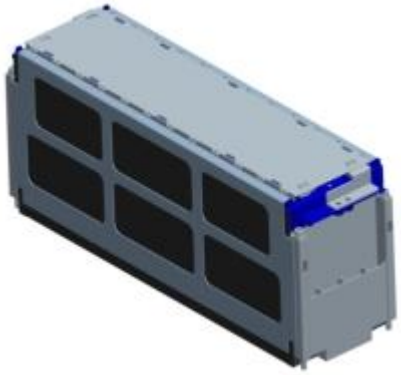


Discharge curve:



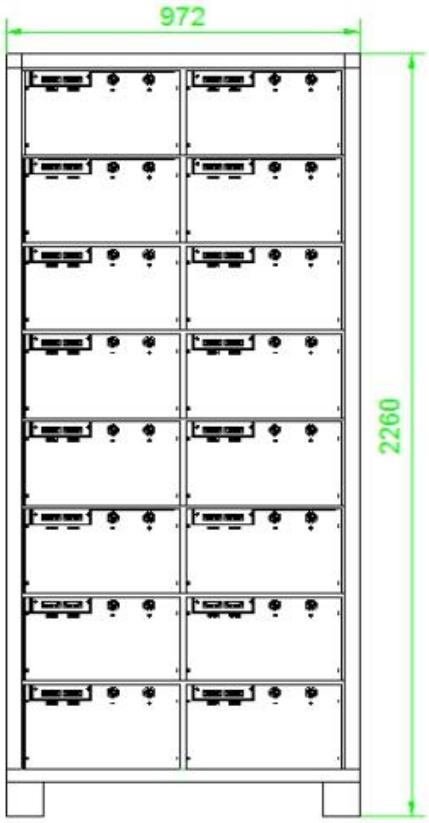
- **Battery module:**

  Model: LF90 4P2S (4cells parallel and 2 in one string, 360Ah 6.4V)
  Description: standard ESS module, with automatic laser welding process.
  Apparent:



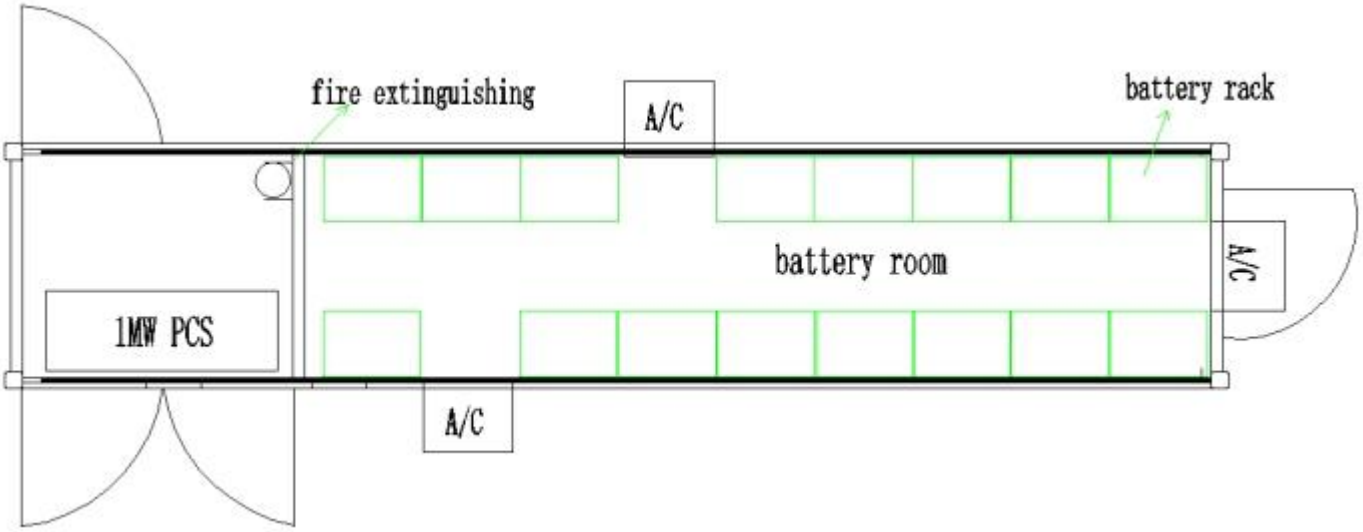
- **Battery pack**
  Model: LF90 4P8S (4 modules in one pack, 360Ah 25.6V)
  Apparent:

- **Battery rack**
  Model: LF90 4P120S (15 modules in one rack, 360Ah 384V, two rack in one string, 768V)
  Apparent:



- **Battery system**

  Model: LF90 4P240S* 8strings (16 rack, 2880Ah 768V)
  Apparent:



- **Pack, rack and system parameter:**

Item		**Parameter**	**Remark**
Battery pack performance	Battery pack	4P8S	
	Total voltage/capacity	25.6V/360Ah	
	Internal resistance	≤10mΩ	
	Dimension	D590*W400*H250mm	
	Weight	≤76kg	
System Performance	Battery rack	240S4P*8set	
	Total voltage/capacity	768V/360Ah*8set	2200kWh
	Charge/discharge rate	0.5C	CC-CV
	Max voltage range	648~876V	2.7~3.65V
	Max charge/discharge current	210A	
	Operating temperature	Charging：0℃~45℃ Discharging：-20℃~55℃	
	Self-discharge of battery	≤5%/Month	
	Battery internal resistance	Less than 500mΩ	
	Recommend SOC	10%~90%	
	Cycle time	≥4000 times @15~35℃，EOL ＞ 1400kWh	