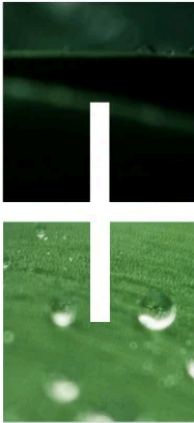


TAB 
Li-Ion batteries



e.motive



TAB **E.MOTIVE**

TAB **e.motive** batteries are designed to deliver longer cycle life, reduction of the total ownership costs, higher productivity and faster charging and are completely maintenance free. TAB BMS (Battery Management System) allows you to monitor the status and health of the battery at any time.

ECOLOGY & PLANET

- TAB e.motive batteries are designed for a sustainable future of our planet
- No liquid acids in case of accidents
- Smaller CO2 footprint
- Better energy efficiency due to lower charging losses

ADVANTAGES



No need for central charging station



More flexibility to decentralized charging stations (in case with onboard charger)



No explosion hazard and no odours due to gassing



Longer operating terms and higher productivity due to fast and opportunity charging



The TAB Li-ion battery system is absolutely maintenance free



No need for security distance to charging facilities - opens new possibilities when planning site layout



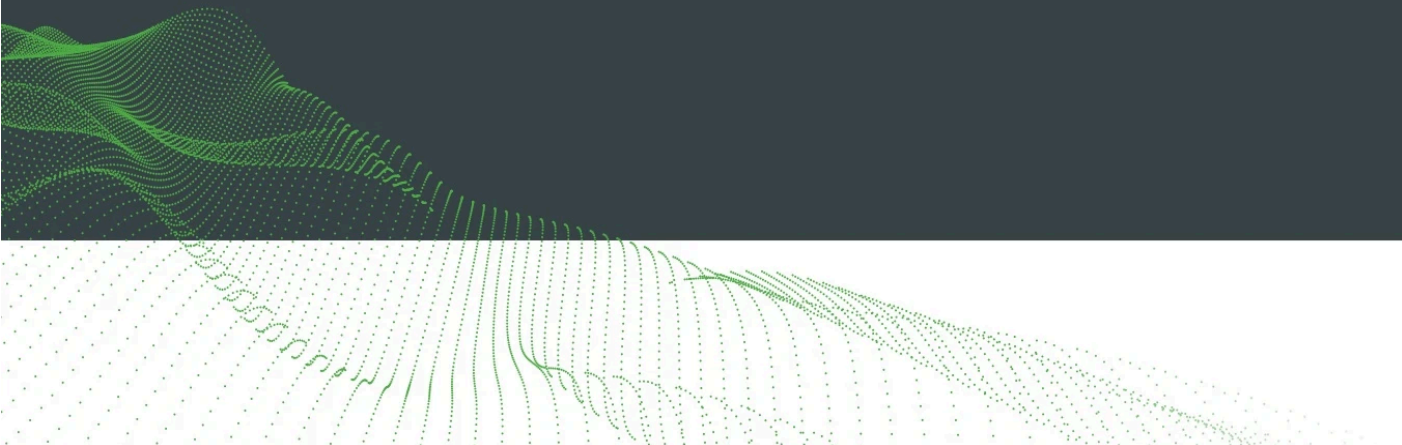


ADVANTAGES OF LI-ION VS. LEAD-ACID BATTERIES

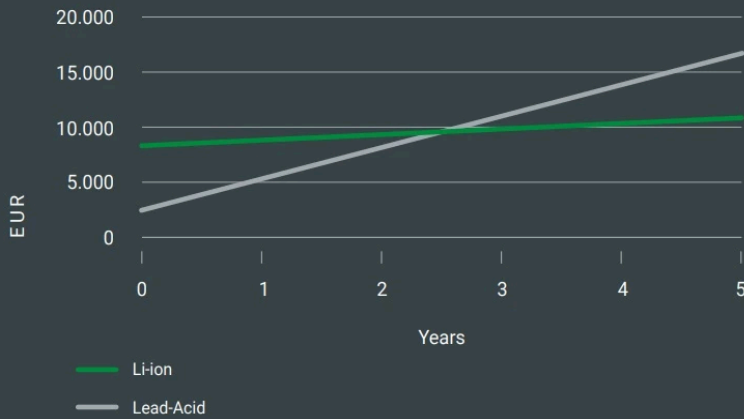
Compared with lead-acid, a Li-ion battery does not require any maintenance and produces no toxic emissions.

Fast (<2 hours) and flexible charging, opportunity charging and two-times longer battery life than lead-acid batteries will increase productivity of your equipment and will take your business to the next level of efficiency.

CHARACTERISTICS	Lead-Acid Batteries	TAB Li-ion batteries
MAINTENANCE	Maintenance required Extra cost	No maintenance No extra cost
CHARGING TIME	8-10 hours 2 or more batteries per truck required for continuous operation	Less than 2 hours 1 battery per truck is enough for continuous operation
OPPORTUNITY CHARGING	No Lower fleet availability due to charging breaks	Yes 100% fleet availability
BATTERY LIFE	1500 charge/discharge cycles Periodic battery replacement	2000 charge/discharge cycles No need to replace batteries
DANGEROUS SUBSTANCES	Yes Battery room is required	No, environmentally friendly Safe and clean technology Battery room is not required
ELECTRICITY CONSUMPTION	Consumes 35% more energy Higher electricity costs	Consumes 35% less energy Lower electricity costs



LI-ION VS. LEAD-ACID BATTERY TOTAL COST



LI-ION VS. LEAD-ACID BATTERY TECHNOLOGY





LI-ION BATTERY

- Operating time approx. 21-22 h
- Fast/Opportunity charging time approx. 2-3 h



LEAD-ACID BATTERY

- Operating time approx. 8 h
- Charging time/rest periods approx. 8 h



INTELLIGENT BATTERY

TAB SERVICE SOFTWARE



Real time data logging



Battery parameter configuration



Battery monitoring



Real time diagnostics



Firmware updating



Ensuring operational safety

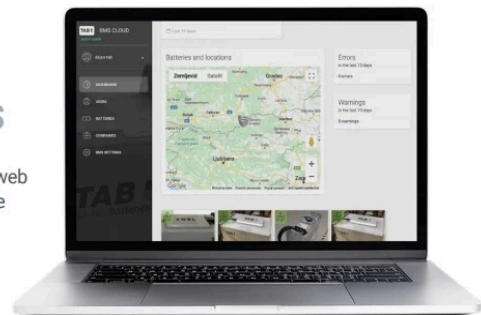
TAB IOT CLOUD BATTERY MONITORING

Battery management IoT Cloud service application for performance improvement and longer service life of the battery.

ADVANTAGES FOR USERS



- **MONITORING AND DIAGNOSTICS:** Cloud web application for real time remote monitoring of the battery conditions via GSM/Lte/Wi-Fi.
- **PROGNOSTICS:** Predictive diagnostics early detection of error and failures.
- **FAULT DETECTION AND PREDICTION:** Higher vehicle availability due to fewer unplanned breakdowns.
- **EVALUATION AND OPTIMIZATION:** Higher vehicle availability due to optimized charging times.





TAB BMS

(BATTERY MANAGEMENT SYSTEM)



MAIN FUNCTIONS

- 12V, 24V and 48V Single unit system
- Master-Slave configuration for High voltage batteries
- LCD Touch screen information display
- Battery monitoring and protection
- Safety improvement



MONITORING

- Cell voltage
- Cell temperature
- Cell resistance
- Battery current
- BMS temperature
- SOC (State of Charge) calculation
- High resolution current measurement



CONTROL

- Safety devices
- Pre-charge circuit
- Standby mode
- Sleeping mode



BALANCING

- 1.3A passive balancing per cell
- 100% cell availability



PROGNOSTIC

- SOH (State of Health) calculation
- Remaining energy/capacity
- Time until Full / Time until Empty



PROTECTION

- Over-voltage
- Under-voltage
- Over temperature
- Over current
- Under temperature charge protection



COMMUNICATION

- Galvanically isolated user defined multi-purpose digital input/output
- Additional user defined relays and digital inputs/outputs on master-slave configurations
- Galvanically isolated RS-485 communication
- Galvanically isolated CAN with 100, 125, 250, 500, 1 MHz bit-rate selection
- CAN to Charger communication



I N T E L L I G E N T B A T T E R Y

**BATTERY SYSTEM
SPECIFICATION**

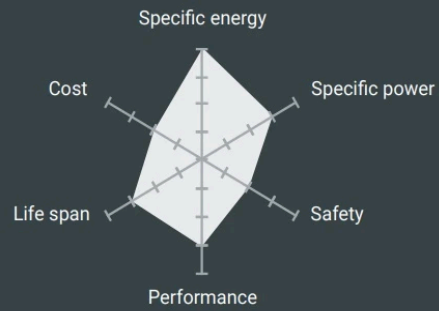
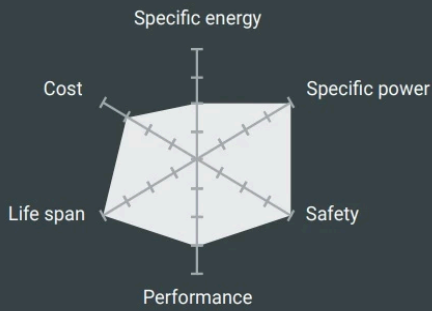
PRODUCT SOLUTION	Li-ion
TEHNOLOGY	LiFePO4
VOLTAGE RANGE	12V-80V
CAPACITY RANGE	50Ah to 1000Ah
DESIGN LIFE (Cycle DOD 80%)	2000+
OPERATION TEMPERATURE	-10/+55 °C
CHARGING TEMPERATURE	0/+40 °C
CHARGING TIME	2h-Fast Charging , 4h-Normal Charging
PROTECTION INDEX	IP54 (IP65 optional)
BATTERY DIMENSION	DIN, BS, Additional Weighted, Customized
BATTERY CHARGER	TAB Li-ion Charger
BATTERY MANAGEMENT SYSTEM	Integrated TAB BMS, (Data Logger Optional)
COMMUNICATION	CAN, RS485, Customized
STANDARDS/CERTIFICATES	UN 38.3, IEC 62619, ISO 9001



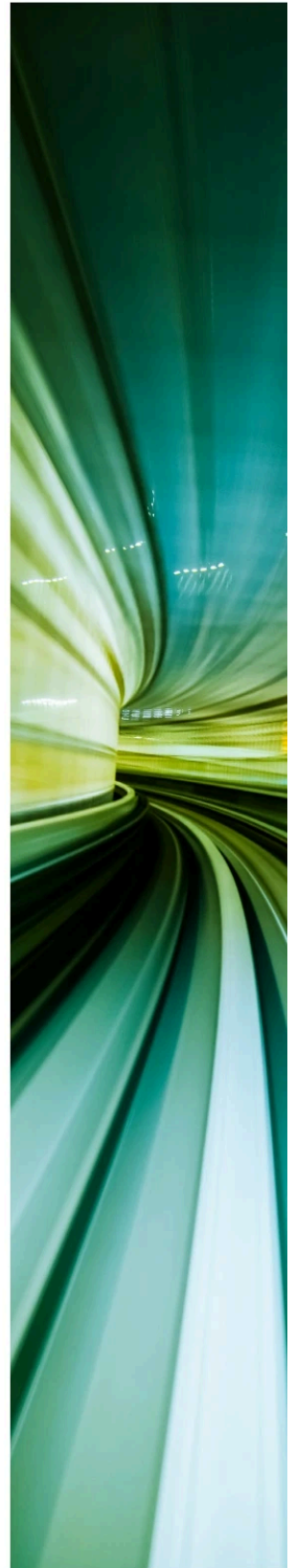
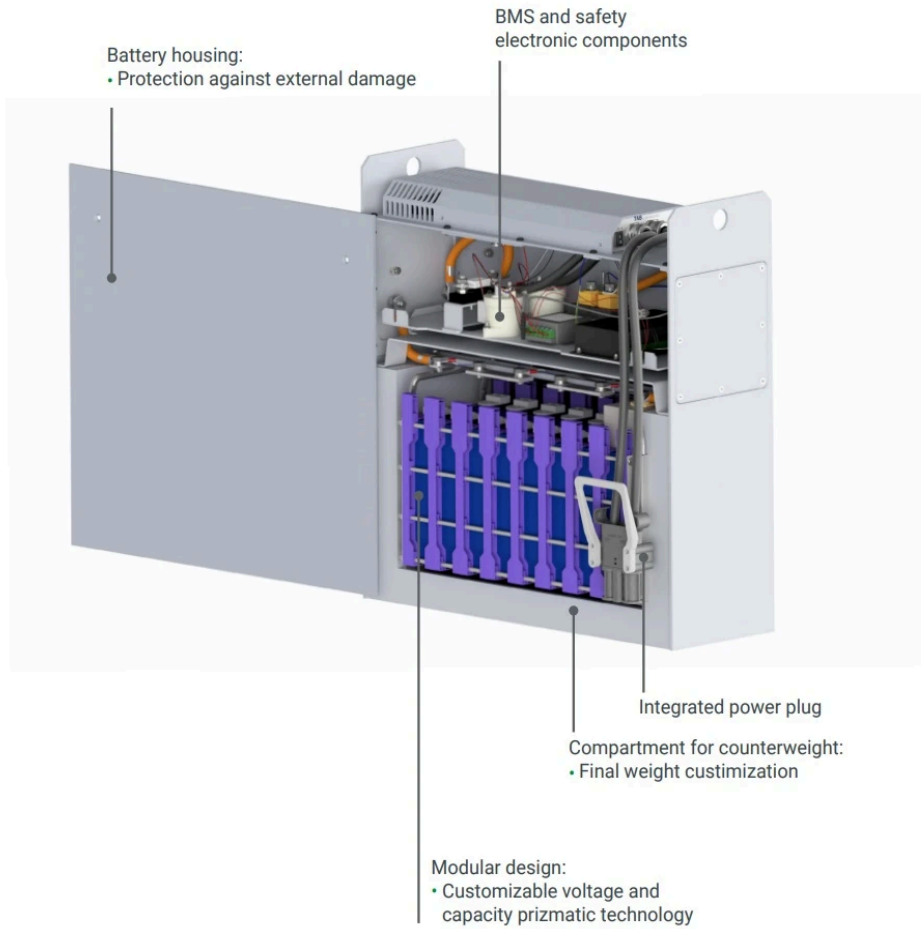


TECHNOLOGY

LFP – LITHIUM IRON PHOSPHATE (LIFEPO4)	NMC-LITHIUM NICKEL MANGANESE COBALT
Good thermal stability	Higher operating voltage
Long cycle life	Low cost
High power rating	Low internal resistance
Safe	Higher operating voltage



BATTERY COMPONENTS





PRODUCT RANGE

Battery Capacity [Ah]	50-1200
Voltage [U]	24-96
Energy [kWh]	1,2-115,2
Cycle life DOD 80%	2000 (0,5C) / 3000 (0,2C)
Dimensions [mm]	Custom
Weight	Custom
Battery socket [A]	DIN 160/320
Protection class	IP54
Operating temp. [°C]	-20 to + 55 (discharge) / 0 to +50 (charge)
Storage temp. [°C]	-20°C to +60°C

With its “PLUG AND PLAY” support, straight-forward replacement for most lead-acid batteries is possible. Normally, no modifications to forklift are needed.

CUSTOM BATTERIES FOR VARIOUS APPLICATIONS



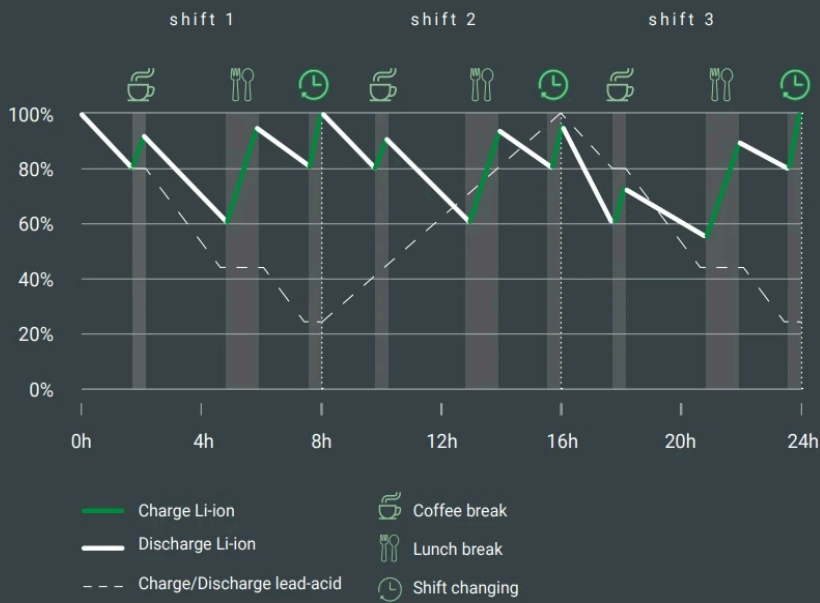
- Light EV
- Cleaning machines
- Cranes and lifts
- Robots
- Industrial drones
- Trains
- Utility vehicle
- UAV
- Boats
- Mining equipment
- Agriculture



OPPORTUNITY CHARGING

TAB Battery Chargers offer the advantage of fast and opportunity charging. Combination of fast and opportunity charging enables multi-shift operation.

STATE OF CHARGE





EFFICIENCY	Up to 94%
OUTPUT VOLTAGE STABILITY	± 1%
COOLING	Forced ventilation
DEGREE OF PROTECTION	IP 20
OPERATING CONDITIONS	From -10 °C up to 40 °C
PROTECTION CLASS	I
STANDARDS/CERTIFICATES	EN 61000-6-2, EN 61000-6-4, EN60950-1

SAFETY FEATURES

Modules and cells are certified according to UN38.3.

ACTIVE SAFETY



Undervoltage and overvoltage protection



Battery protected with high power contactors



CAN controlled charging process



Pilot contacts for anti-sparking



PASSIVE SAFETY



Thick battery box walls



IP54 or IP65 protection



Fuses on main powertrain



Short circuit protection



Overcurrent protection

PURE ENERGY, MAXIMUM POWER



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TAB 
Li-Ion batteries

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